THE RELATIONSHIP BETWEEN EARLY AGE OF FIRST SEXUAL INTERCOURSE AND VULNERABILITY TO DEPRESSION AMONG ADOLESCENTS

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DEDICATION

This thesis is dedicated to the memory of my mother, Helen L. Jamieson. I can only imagine how proud she would be of me.

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ABSTRACT

Past empirical literature has provided conflicted results regarding the association between adolescent coitus and depression. While some studies conclude that those youth who are sexually active may be at risk for depression, others provide contrary results, or findings that are only representative of high-risk sexual behaviors such as intercourse without a condom. Thus, the results are unclear as to whether depression results directly from coitus, or if this relationship is spurious; that is, there may be biological, psychological, or sociological variables that may predict *both* depression and early sexual intercourse. Using the Add Health restricted dataset, I analyzed the depressive symptomatology of adolescents over a seven-year time period. The final sample (n=6,510) was comprised of 49.35% male (n=3,213) and 50.65% female (n=3,297) participants. Results indicated that the relationship between earlier adolescent sexual intercourse and later depressive symptomatology is spurious. Although an earlier age of first coitus is predictive of later depressive symptomatology, both variables appear to be concomitant outcomes of the biopsychosocial process. Thus, while one may be able to use early coitus as a marker for subsequent depressive symptomatology, it does not occur because of early coitus. Furthermore, the reverse relationship was not found to be significant in this study. That is, higher levels of depressive symptomatology do not predict an earlier age of first sexual intercourse in adolescents.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

Past empirical literature has provided conflicted evidence regarding the association between adolescent coitus and depression. While some studies conclude that youth who are sexually active may be at greater risk for depression (Hallfors et al., 2004; Rector, Johnson, & Noyes, 2003; Tubman, Windle, & Windle, 1996), others provide contrary results (Lehrer, Shrier, Gortmaker, & Buka, 2006; Sabia, 2006), or findings that are only representative of high-risk sexual behaviors such as intercourse without a condom (Hallfors, Waller, Bauer, Ford, & Halpern, 2005). Thus, the results are unclear as to whether depression results directly from coitus, or if this relationship is spurious; that is, there may be biological, psychological, or sociological variables that may predict *both* depression and early sexual intercourse. In addition, each of the previous studies examining the relationship between depression and sexual intercourse has considerable limitations, which make the relationship between depression and coitus unclear. By grounding this analysis within a biopsychosocial framework, this thesis will move beyond previous cross-sectional and one year longitudinal analyses of the National Longitudinal Study of Adolescent Health (Add Health) to examine all three Waves of the restricted dataset. Thus, the current study seeks to understand the association between earlier sexual intercourse and depressive symptomatology in adolescents residing in the United States.

This study is separated into six sections, including: 1) a review of the existing empirical literature on the association between early adolescent sexual intercourse and adolescent depression; 2) a review of the theoretical framework that guides this study; 3) a description of the survey and methodology used in this thesis; 4) the analytic strategy; 5) the results of the analyses; and 6) a discussion of the findings, implications, and future research directions.

Following this introductory section, a review of adolescent depression and early adolescent sexual intercourse, including a review of the existing six studies on the relationship between these two variables, is presented. This section will include the limitations of these six studies and how this thesis moves beyond past empirical research to address these limitations. In the second chapter, the biopsychosocial model proposed by George Engel (1977) will be introduced. Biological, psychological, and sociological factors that influence the association between early adolescent coitus and depression will be provided in this section, including the four research questions and sub-analyses that this study addresses. The third chapter presents a description of the Add Health project. This includes an explanation of the sample characteristics, the type of information collected, the sampling design, and the survey administration. This third chapter also addresses the dependent and independent variables that will be analyzed. The fourth chapter describes the analytic strategy used to determine the association between age of first coitus and psychological distress in this thesis. The fifth chapter presents the results from the bivariate and multivariate analyses, including the results from the four research questions and sub-analyses. The sixth chapter is dedicated to the discussion of the results

from the bivariate and multivariate analyses. Limitations of the present study are presented in this chapter followed by the implications of the current study's findings. Finally, the chapter ends with future research directions and concluding remarks.

Background

Adolescent Depression

Depression is a complex (Sullivan, Neale, & Kendler, 2000), debilitating, and prevalent mental illness that affects approximately 121 million people worldwide (Greenberg et al., 2003; Kessler & Ustun, 2004; WHO, 2007). It is a recurrent disorder (Piccinelli & Wilkinson, 1994) that is associated with an increased risk of premature death (Harris & Barraclough, 1998), interpersonal and psychosocial difficulties, substance abuse, and suicide (Stanard, 2000). Depression is characterized by sadness, feelings of worthlessness, and suicidal thoughts or behavior.

Adolescent depression differs from adult depression, in that, it is typified by five groups of symptoms that appear to be specific to youth; 1) emotional, 2) cognitive, 3) somatic, 4) behavioral, and 5) physical. For example, an adolescent may experience the following emotional symptoms: pessimism, intense sadness, and extreme sensitivity to rejection or failure. Cognitively, they may experience reduced concentration, self-criticism, fear of death, suicidal thoughts, suicide attempts, or delusions. Exhaustion and physical pain would be examples of somatic symptoms. Behavioral symptoms can include social withdrawal, poor communication, refusing to attend school, poor school performance, reckless behavior, and alcohol or substance abuse. Finally, physical symptoms of depression may include weight loss or gain, appetite disturbances, disrupted

sleep patterns, and psychomotor retardation or agitation (APA, 2000; CMHO, 2001; Greenberg et al., 2003; Kirkcaldy & Siefen, 1998). Although empirical studies have found evidence of depressive symptoms in children (Carson, Butcher, & Mineka, 1996), adolescence appears to be the age when most mental illnesses, especially depression, begin to manifest (Kaltiala-Heino, Kosunen, & Rimpela, 2003; Scourfield et al., 2003; Udry et al., 2003). As a result, adolescents also report a higher prevalence rate of depressive symptoms than adults (Allgood-Merten, Lewinsohn, & Hops, 1990; CMHO, 2001; Wade & Cairney, 1997). In addition, those teens who suffer from depression in adolescence are at an increased risk of recurrent episodes of depression in adulthood (Lewinsohn, Rohde, Klein, & Seeley, 1999; Pine, Cohen, Cohen, & Brook, 1999; Rao et al., 1995). This continued risk from youth to adulthood may be as large as two or three times compared to those who have never had a depressive episode during adolescence (Pine, Cohen, Gurley, Brook, & Ma, 1998), and this risk appears to be consistent across cultures (see Canals, Domènech-Llaberia, Fernández-Ballart, & Martí-Henneberg, 2002). Thus, in addition to the multiple changes that accompany adolescence, depression is a possible struggle for many teens that could continue into adulthood.

Adolescent Sexual Intercourse

The period from adolescence to early adulthood is often the time when the initiation of sexual intercourse occurs. Although adolescent sexual behavior is often viewed negatively by individuals (White & DeBlassie, 1992), its initiation exists as a part of the life experience (Smith, Guthrie, & Oakley, 2005). Positive outcomes of teen coitus can include an increased intimacy with one's partner, however, it is also associated with

considerable negative outcomes. These outcomes can include teenage pregnancies resulting in a higher likelihood of a lifetime of low socioeconomic status for teenage parents, future marital dissatisfaction and marital discord, sexually transmitted infections (STIs), the human papilloma virus (HPV), a possible increased risk of cervical cancer and death (since STIs, cervical dysplasia, and pregnancy can be sources of death among adolescent and adult women) (Gotlib, Lewinsohn, & Seeley, 1998; Greenberg et al., 2003; Hallfors et al., 2004; Kahn, Gardner, Prescott, & Kendler, 2002; Kessler et al., 1997; Lam et al., 2004).

In 2005, it was reported that 48% of males and 46% of females in the United States in grades 9 to 12 had experienced coital involvement (Centers for Disease Control and Prevention). Since a substantial number of teens are engaged in sexual intercourse, it would be valuable to examine the underlying association that earlier coitus may have on psychological distress.

Adolescent Sexual Intercourse and Depression

Amid the large and expanding literature on depression, little research exists that examines the relationship between sexual intercourse and depression among adolescents. Among adults, depression is usually characterized by a *decrease* in sexual desire, arousal, and fantasy (Cyranowski, Frank, Cherry, Houck, & Kupfer, 2004). Decreased sexual desire and intercourse have been found in persons with major depression who are not receiving antidepressive treatment (Kennedy, Dickens, Eisfeld, & Bagby, 1999), and thus, it seems logical to deduce that depressed persons may be less likely to engage in sexual intercourse due to their depressive symptoms. Nonetheless, to date, research on

adolescent sexual intercourse and depression has found that youth who engage in earlier sexual intercourse are at an increased risk of depression (Hallfors et al., 2004; Hallfors et al., 2005; Rector et al., 2003; Tubman et al., 1996). The following discussion presents the current six published studies that examine the relationship between adolescent coitus and depression, including the limitations of these studies.

Earlier Sexual Intercourse Predicts Depressive Symptomatology

Study #1

The first empirical study that linked depression and sexual intercourse among adolescents was completed by Tubman et al. in 1996. The main purpose of their longitudinal study was to investigate intercourse patterns among White, suburban, middle class adolescents who were in grades 10 and 11. Sexual behavior in their study was assessed by the question, "how many times have you engaged in sexual activity involving actual intercourse". Depressive symptoms were assessed using the 20-item National Institute of Mental Health Centre for Epidemiologic Studies-Depression Scale (CES-D). Tubman et al. concluded that those adolescents who engaged in earlier onset sexual intercourse reported higher levels of depressive symptomatology.

Although Tubman et al.'s (1996) study had a robust measure of depressive symptomatology, it lacked a clear operational definition of sexual intercourse. From their definition of coitus ("how many times have you engaged in sexual activity involving actual intercourse"), it cannot be determined if they measured oral, anal, or vaginal intercourse. Earlier coitus, in the form of oral sex, may have different implications for later depressive symptomatology when compared with vaginal intercourse. For example,

anal sex may be more common among teens who engage in risk behaviors, and as such, these teens may have a higher likelihood of depressive symptomatology (Yu et al., 2007). In addition, although their study was longitudinal, it was only two years in length. Empirical research benefits from longitudinal analyses that are more than a couple years in length that accommodate the multiple changes that are characteristic of adolescence. Finally, the white, middle class, suburban sample that they utilized may differ dramatically from a nationally representative sample. Thus, Tubman et al.'s (1996) findings may not be applicable to many adolescents.

Study #2

The second study, analyzed by Rector et al. in 2003, was the first to use the Add Health dataset. The Add Health is a nationally representative, school-based, longitudinal study of adolescents who were in grades 7 through 12 in the United States (including Alaska and Hawaii) in the 1994-1995 academic school year. To date, it is the largest and most comprehensive longitudinal survey of youth to examine the social dimensions of development from adolescence through to adulthood (Udry et al., 2003). The Add Health contains three Waves of data that follow teens as they transition from adolescence to adulthood. The first two Waves are one year apart, while the third Wave of data collection occurs 5 years after the second Wave. Two datasets (restricted and public-use) of the information collected in each Wave are available for analyses. The restricted dataset includes all information collected and requires a sensitive data agreement, while the public-use dataset is a sub-sample of the restricted dataset.

Using the second wave of the Add Health public-use dataset, Rector et al. (2003) assessed sexual intercourse and depression among adolescents aged fourteen to seventeen. Depression was operationally defined by one question from the CES-D; "How often, in the past week, did you feel depressed?". Respondents whose answers were "a lot of the time" or "most of the time, or all of the time" were classified as being depressed. Those adolescents who answered "never or rarely" or "sometimes" were not considered to be depressed. Sexual intercourse was defined as "when a male inserts his penis into a female's vagina". Adolescents who answered 'yes' when asked if they had "ever had sexual intercourse" were labeled as "sexually active", while those adolescents who answered 'no' to this question were labeled as "not sexually active" in their study.

Rector and colleagues found that sexual intercourse and depression were highly correlated. In their study, 25% of sexually active girls and 8% of sexually active boys reported being depressed "all, most, or a lot of the time", whereas 7.7% of non-sexually active girls and 3.4% of non-sexually active boys reported being depressed "all, most, or a lot of the time". Using logistic regression analyses, a higher likelihood of depression among sexually active teens was found after adjusting for gender, race, age, and family income. Rector et al. concluded that sexually active teens were more likely to be depressed than teens who were not sexually active.

Rector et al.'s study prompts multiple concerns. First, only one of the 20-items in the CES-D scale was used to measure depression. The use of a single item to assess depression from a multi-item scale that assesses depressive symptomatology raises questions about the utility of the findings in this study. While previous research on the

CES-D scale to identify clinical cut-points for depression among adolescents has provided valid results when compared to a clinical diagnosis, this occurred when more than one of the scale items was used (Roberts, Lewinsohn, & Seeley, 1991). Thus, the confidence that this study is measuring depressive symptomatology is greatly reduced because the one item that was utilized in their study was also dichotomized. As a result, it is difficult to determine if Rector et al. adequately analyzed psychological distress. To provide a comprehensive analysis of depression or depressive symptomatology, an inclusive operational definition should be employed.

Furthermore, because Rector et al.'s study was cross-sectional, it can only assess levels of sexual activity and depression at one point in time. Thus, these results may only be applicable to adolescents in the year 2003. Finally, due to the cross-sectional nature of the study, their results would only be able to account for a statistical association rather than causal direction. Longitudinal analyses that include data from Wave I, II, and III of the Add Health would provide a clearer perspective of the relationship between coitus and depression.

Study #3

The third study on sex and depression in teens was another cross-sectional study that analyzed Wave I of the Add Health dataset (Hallfors et al., 2004). In this study, the restricted dataset was used. Depression was assessed using 18 items from the CES-D scale, and was dichotomized at a cut point of $\geq$22 for males and $\geq$24 for females to indicate major depressive disorder (as per Roberts et al., 1991). Hallfors et al. (2004) found that one in ten youth in 7th through 12th grade met the criteria for major depression

in their study. Through the use of logistic regression analysis, they reported that adolescent sexual intercourse was associated with depression while controlling for gender, age, race (consisting of Whites, Blacks, Hispanic, and Other), parental education, and family structure (two resident parents, single mother, and other). Although the main focus of their study was assessing *high-risk* behaviors (i.e. smoking, drinking, and unprotected sexual intercourse) and depression, Hallfors et al. found that those adolescents who were having sexual intercourse were 2.65 times more likely to be depressed than abstainers. They also found that Hispanics, "Other" race, low parental education, and "Other" family structure were significant contributors to the risk for depression.

While the study by Hallfors et al. provides a sound cross-sectional analysis of the association between sexual intercourse and depression, it would be improved through the use of longitudinal analyses using data from more than one Wave of the Add Health. Utilizing all three Waves of the Add Health would provide a thorough examination of the relationship between earlier coitus and depression as youth progress from adolescence to adulthood. Furthermore, Hallfors et al. (2004) focused on the identification of major depressive disorder using a cut-point for the CES-D. Examining depressive symptomatology as a continuous variable, rather than a dichotomous variable, may allow for a more precise relationship between earlier coitus and mental health. Finally, sexual intercourse was not clearly defined in Hallfors et al.'s (2004) study. Thus, it is difficult to determine what type of sexual behavior was assessed and whether it was confined only to penile/vaginal intercourse.

Study #4

In a follow-up study, using Waves I and II of the restricted Add Health dataset, Hallfors et al. (2005) conducted a one-year longitudinal analysis that examined *high-risk* behaviors and depression. Respondents were in 7^{th} to 11^{th} grade in Wave I, and 8^{th} to 12^{th} grade in Wave II. Depression was assessed using 18 CES-D items; two items had different wording in Wave II, and an additional two items developed for the Add Health were added to the depression measure. Depression was dichotomized at ≥22 for males and ≥24 for females to detect for major depressive disorder in adolescents (as per Roberts et al., 1991). Multinomial and multivariate logistic regression analyses tested the temporal ordering of high-risk sexual intercourse and depression, while controlling for pubertal timing, race, age, gender, SES, and family structure. Hallfors et al. found that prior depression did not predict sexual behavior among youth. That is, depressed youth did not seek out sexual intercourse to uplift their negative mood. However, those youth who reported being engaged in sexual intercourse in Wave I were more likely to report being depressed in the subsequent wave.

Once again, a definition of sexual intercourse was not provided in this study, so it is difficult to determine the types of sexual behaviors analyzed. Furthermore, by examining *high-risk* sexual behaviors, Hallfors et al. (2005) may not have found a relationship between earlier sexual intercourse and depression apart from high-risk sexual activities. Therefore, it is not clear whether the relationship between depression and earlier sexual intercourse exists that does not include high-risk sexual behaviors.

In summary, the four aforementioned studies on the relation between adolescent sexual intercourse and depression provide evidence that earlier sexual intercourse may lead to depressive symptomatology in teens. However, due to the various limitations of the studies as outlined above, it is difficult to ascertain the extent of this relationship. Two additional studies conducted in 2006 examine the temporal ordering of depression predicting sexual intercourse, which provide contrary results to the previously mentioned four studies.

Depressive Symptomatology Predicts Earlier Sexual Intercourse

Study #5

Lehrer et al. (2006) conducted the first study that provided contrary results to the previous empirical evidence. In their study, they tested whether sexual *risk* behaviors predicted depression in a longitudinal analysis of Waves I and II of the Add Health public-use dataset. Respondents were between the ages of 12 and 21 in Wave I. Sexual *risk* behaviors were defined as condom and birth-control non-use at last intercourse, alcohol and/or drug use at last intercourse, or having three or more sexual partners. Depression was assessed in Wave I and Wave II using 18 items from the CES-D scale. Two of the depression items were rephrased to measure depression over one year instead of one week. An additional two items were added to the depressive measure. Answers were separated into 'low', 'moderate', and 'high' categories to assess symptom levels of depression. Regression analyses controlled for respondent age (divided into early, middle, and late adolescence), race, poverty status, family structure (two parents, stepfamily, and Other), religious involvement, time between interviews, same-sex

attraction/behavior, and intercourse at ≤10 years of age. Lehrer et al. concluded from their analyses that adolescents with high depressive symptomatology were more likely than those with low depressive symptomatology to report sexual *risk* behaviors one year later.

While Lehrer et al. (2006) identified a temporal ordering that was opposite to the previous discussed research, this relationship may have only existed as a result of their focus on sexual *risk* behaviors instead of earlier sexual intercourse. Additional research on sexual activities that are not classified as 'risky' sexual behaviors will add to past research.

Study #6

The final study by Sabia (2006) was intended as a replication of Rector et al.'s (2003) study, analyzing earlier teen sex and depression among adolescents through the use of Waves I and II of the Add Health. Respondents included in this study were in 7th to 11th grade in Wave I. Depression was assessed by the question, "How often was the following true during the last week? You felt depressed", and was dichotomized for analysis. Sexual intercourse was assessed by the question, "Have you ever had sexual intercourse? When we say sexual intercourse, we mean when a male inserts his penis into a female's vagina". Sabia's analyses indicated that 10% of females and 8% of males reported becoming sexually active between Wave I and Wave II. Using ordinary least squares (OLS) regression analyses to assess the data, Sabia concluded that early sexual intercourse was not the "cause" of depression, but rather an "indicator" of depression. Thus, those adolescents who engaged in earlier sexual intercourse likely experienced

depressive symptomatology, however, sexual intercourse did not cause the subsequent depression.

By replicating Rector et al.'s (2003) study, Sabia's research is involuntarily fraught with similar limitations (i.e. a one-item measure of depression). Sabia employs a more sophisticated statistical analysis in his study than Rector et al., however, he completes the final analyses with OLS instead of logistic regression analysis. By using OLS, Sabia does not accurately assess the relationship between depression (a dichotomous variable) and earlier teen coitus, as this was the incorrect statistical analysis.

Research Objective

Depression and sexual intercourse are relevant to today's youth, in that, adolescence is often the time when teens experience both depression and their first genital union. The previous six studies detail an inconclusive relationship between early coitus and psychological distress. Four of the aforementioned studies have linked depression and coitus together, such that, earlier sexual intercourse may be predictive of future depressive symptomatology. However, two additional studies on this topic provide opposing results. Thus, it is difficult to determine if earlier coitus predisposes a person to depression, or if depressed individuals seek out sexual intercourse to relieve their symptoms. Or perhaps, whether the relationship between these variables is spurious, that is, they are both concomitant outcomes predicted by other factors.

It is possible that an earlier age of first sexual intercourse might be predictive of subsequent depression due a deviation from implied social norms. For example, Meier (2007) suggests that such distress may result from those who are involved in earlier coital

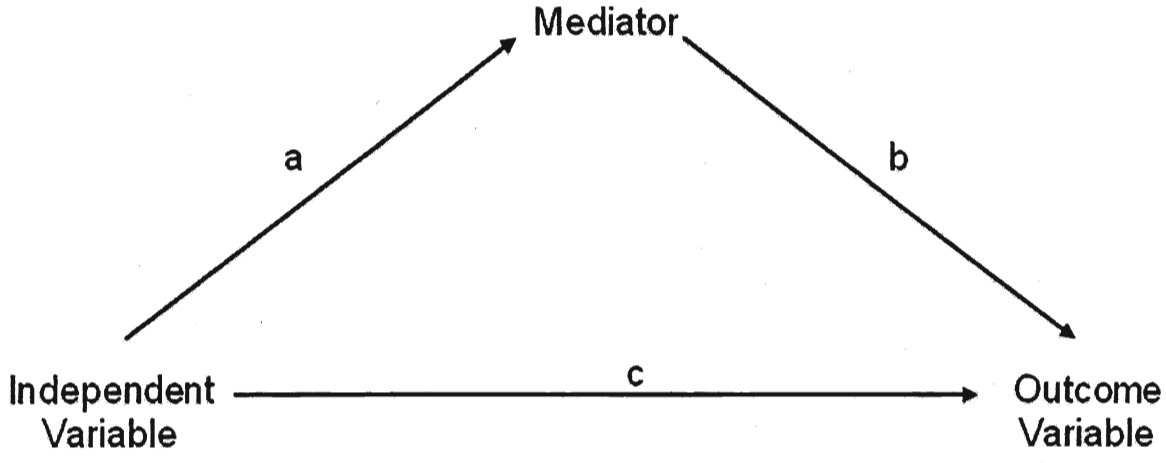
activity than what the norm suggests is the appropriate age. Furthermore, younger adolescents may be unprepared for the psychological and emotional involvement of an intimate relationship, and thus, may experience depressive symptomatology. However, depressive symptomatology may influence an earlier age of sexual intercourse due to the positive emotions that coitus evokes. So, depressed individuals may seek out sexual intercourse to uplift their negative mood.

Spurious vs. Mediating Variables

A variable is said to act as a mediator when it accounts for the relationship between an independent and an outcome variable (Baron & Kenny, 1986). A visual representation of this relationship is presented in Figure 1. This model provides two causal paths that lead to the outcome variable. The first causal path is the direct impact of the independent variable on the outcome variable (Figure 1, Path c). The second causal path is the impact of the mediator variable on the outcome variable (Figure 1, Path b). A path also exists from the independent variable to the mediator (Figure 1, Path a). In this model, there are three requirements for a variable to function as a mediator. First, differences in levels of the independent variable significantly account for differences in the mediator (Path a). Second, differences in the mediator significantly account for differences in the dependent variable (Path b). Finally, when Paths *a* and *b* are controlled, a previously significant relationship between the independent and outcome variable is no longer significant. Thus, the strongest mediation occurs when Path *c* is zero (Baron & Kenny, 1986).

This thesis proposes a spurious relationship between earlier sexual intercourse and

Figure 1



depressive symptomatology. A spurious relationship occurs when the association between an independent and outcome variable is predicted by other factors. Thus, if one were to use Figure 1 as a model, Path *b* would no longer be significant in a spurious relationship. However, a significant relationship would remain on Paths *a* and *c*. Therefore, in Figure 1, the biopsychosocial variables in this thesis (represented by the Independent Variable) would be predictive of age of first sexual intercourse (proposed Mediator) and depressive symptomatology (Outcome Variable).

In summary, the objective of this thesis is to explore the equivocal findings of previous empirical research on adolescent depression and sexual intercourse by examining it longitudinally over a longer time interval and grounding it within a biopsychosocial framework to assess its directionality. A spurious relationship is proposed to be involved in the association between early coitus, depressive symptomatology, and the biopsychosocial variables that are assessed in this study.

CHAPTER 2: THEORETICAL FRAMEWORK

Biopsychosocial Model

Proposed by psychiatrist Dr. George Engel in 1977, the biopsychosocial model postulates that not only are somatic variables involved in illness, but also social, psychological, and behavioral variables. Posed as a challenge for medicine and psychiatry, the biopsychosocial model suggests that one cannot explain the complexity surrounding an illness by examining a single dimension. Only when all perspectives are included can one comprehensively explain a disorder.

Adolescent depression has been studied from various perspectives including a biological, a psychological, and a sociological perspective. However, the myopic focus of a specific discipline limits the scope of knowledge, preventing what Engel argues is a comprehensive explanation. For example, past somatic approaches have been unsuccessful in explaining a large proportion of the variation in rates of depression; biology alone has been able to account for only 38% of the variability in depression (Kendler, Gatz, Gardner, & Pedersen, 2006). As a result, it is important to examine adolescent depression from a broader theoretical perspective. Furthermore, apart from an evolutionary theorist's perspective, sexual behavior can too be considered, in part, a social activity that would be best explained by a model that incorporates sociological and psychological, as well as, biological aspects. Utilizing Engel's biopsychosocial model to incorporate these three perspectives should provide a more comprehensive analysis of adolescent sexual intercourse and its relation to adolescent depression. To accomplish this, it is first necessary to review the literature on adolescent depression and sexual

intercourse across these three domains. The remainder of this chapter will discuss the biological, psychological, and sociological determinants of both early coitus and depression in adolescents. It will conclude with a summary of the biopsychosocial variables in this study and the four research questions and sub-analyses that will be guiding the statistical analyses.

Biological Determinants of Adolescent Sexual Intercourse and Depression

To date, hormones, neurotransmitters, genetics, sex differences, pubertal maturity, and race have all been studied in an attempt to understand coitus and depression from a biological perspective.

Hormones

During gestation, hormones are responsible for the process of sexual differentiation in a fetus. During puberty, hormone levels in the body (testosterone for men and estrogen and progesterone for women) increase and are involved in the preparation of the body for sexual events (such as pubertal changes, menstrual cycles, sexual behavior, and pregnancy). In males, testosterone is produced in the testes and the pituitary. Testosterone is responsible for the development of masculine characteristics such as penis growth and sperm-producing capabilities. Udry, Billy, Morris, Groff, and Raj (1985) suggest that an increase in testosterone at puberty is strongly correlated with first intercourse, particularly in boys. In their 1985 study, it was found that 69% of boys in grades 8 to 10 whose testosterone was in the highest quartile had engaged in sexual intercourse, compared with 16% of boys in the lowest quartile. Similarly, 62% of boys with testosterone in the highest quartile had masturbated, compared with 12% of the boys

in the lowest quartile. These effects were also uncorrelated with age; hence, these effects were not due to older boys having more testosterone or more sexual experience. Therefore, it appears that an increase in testosterone in boys is strongly associated with first intercourse.

In females, estrogen stimulates the growth of the uterus, vagina, pelvis, and breasts, while progesterone is responsible for the menstrual cycle, pregnancy (supporting gestation), and embryogenesis (Hyde & DeLamater, 1997). Research indicates that, in women, estrogen is the primary hormone governing pubertal development, while androgens appear to be related to sexual desire (Hutchinson, 1995). When androgens (the adrenals and ovaries) are removed (for example, in oophorectomy; the surgical removal of the ovaries), women lose their sexual desire. However, if these women are given testosterone, their sexual desire increases (Shifren, Nahum, & Mazer, 1998; Shifren et al., 2000). Similarly, androgen therapy has been successfully utilized in the treatment of women with low sexual desire (Kaplan & Owett, 1993).

The pituitary gland and the hypothalamus function together in the brain and are important in the regulation of testosterone, estrogen, and progesterone hormones to the body. The pituitary gland regulates the gonads (testes and ovaries), while the hypothalamus regulates the pituitary gland, in addition to eating, drinking, and sexual behavior (Hyde & DeLamater, 1997). When the body is ready for sexual activity, testosterone and androgens appear to be the antecedent to coitus (Halpern, Udry, Campbell & Suchindran, 1993; Hutchinson, 1995). In summary, testosterone, estrogen,

progesterone, and androgens prepare the body for sexual intercourse, while the hypothalamus and the pituitary gland help to regulate these hormones.

Past research supports the role of hyperactivity in the hypothalamic-pituitary-adrenocortical axis (HPA) in depression (Duval et al., 1997). The HPA is a major part of the neuroendocrine system that is activated during stress. It is comprised of the hypothalamus located in the brain, the pituitary gland located below the hypothalamus, and the adrenal gland located at the top of each kidney. The HPA regulates digestion, the immune system, mood, sexuality, and energy consumption. Upon activation, the HPA initiates three systems. First, the HPA stimulates the hypothalamus into discharging corticotrophin-releasing factor (CRF). CRF is a 41 amino acid-containing peptide that mediates the body's response to stress. CRF is believed to be involved in sleep and appetite disturbances, reduced libido, and psychomotor changes associated with depression (Taylor, 2003). In depressed persons, a hypersecretion of CRF from the hypothalamic and extrahypothalamic neurons occurs, and as a result, elevated levels of CRF in cerebrospinal fluid can be found (Arborelius, Owens, Plotsky, & Nemeroff, 1999; Nemeroff et al., 1984). Second, the pituitary gland secretes adrenocorticotropic hormone (ACTH), which stimulates the adrenal cortex. Third, the adrenal cortex releases glucocorticoids such as cortisol (Taylor, 2003). During stress, corticosterone levels drastically increase. Thus, it is not surprising that frequent and prolonged cortisol secretion (Duval et al., 1997; Taylor, 2003) and elevated plasma cortisol concentrations have been observed in depressed persons (Arborelius et al., 1999). Furthermore, hypercortisolemia may lead to the dysregulation of catecholamine and thyroid systems in

persons experiencing unipolar depression with melancholic and psychotic features (Duval et al., 2006).

In summary, it is believed that an overactive HPA triggers a transformation in the neurological functioning of the brain that leads to depression. The HPA is frequently activated in depression (Taylor, 2003) and is normalized after successful treatment with antidepressant medications (Arborelius et al., 1999). Depressed persons also have greater pituitary volume and pituitary cross-sectional area than controls (Krishnan et al., 1991), reinforcing the role of a hyperactive HPA in depression.

Neurotransmitters

Research also suggests a link between the dopaminergic system in the brain and its influence on the regulation of sexual behavior (Giuliano & Allard, 2001; McKim, 1997; Melis & Argiolas, 1995). Dopamine is found in the body as both a neurotransmitter that activates the dopamine receptors in the brain, and as a neurohormone that is released by the hypothalamus to inhibit the release of prolactin from the pituitary. The release of prolactin, in turn, suppresses male sexual activity (McKim, 1997). Dopamine is a catecholaminergic transmitter that is involved in the reinforcement of behaviors through feelings of enjoyment and delight. Many drug users have become chemically addicted, in part, as a result of the increased dopamine activity produced by drugs such as amphetamines. Therefore, it is postulated that an increase in dopamine activity in the brain facilitates copulatory activity. Thus, dopamine may relate to an increase in sexual activity indirectly because it inhibits prolactin, which is a sexual suppressant.

In addition, low levels of dopamine and serotonin in the brain have been associated with depression (Duval et al., 1997). Serotonin (5-hydroxytryptamine or 5-HT) is the most notable monoamine neurotransmitter associated with depression. Isolated and named in 1948 by Rapport, Green, and Page, serotonin is believed to be involved in the regulation of body temperature, mood, sleep, vomiting, sexuality, and appetite. It is found primarily in the Raphe nuclei of the brainstem, with the majority of serotoninergic concentration located in the B_7 and B_8 region (Galkina, Al'perina, Suslyakova, & Devoino, 1991). The amino acid L-tryptophan is the precursor for the synthesis of serotonin. Since serotonin cannot cross the blood-brain barrier, it is synthesized by L-tryptophan to facilitate its movement into the brain. After this process, the aromatic L-amino acid decarboxylas (AACD), an enzyme involved in the synthesis of serotonin, converts 5-HTP to 5-HT. Once converted, serotonin is able to travel electrically through the brain via neurotransmission.

Once serotonin binds to its specific receptor sites on the dendrites of a neuron, it is passed down the neuron's axon to the postsynaptic terminal buttons where it is released into the synaptic cleft to attach to another neuron. This serotonergic action is terminated primarily through the 5-HT reuptake transporter, which does not allow for the excessive discharge of serotonin. Therefore, most pharmacologic drugs used to treat unipolar depression work by increasing serotonin levels in the brain. For example, the most recent pharmacological drugs for depression, know as Selective Serotonin Reuptake Inhibitors (SSRI's), target the reuptake of serotonin to ensure adequate amounts of the neurotransmitter are present in the brain.

Genetics

Rodgers, Rowe, and Buster (1999) found that genetics accounted for individual differences in age of first sexual intercourse. Thus, certain individuals were more likely to engage in earlier coitus based on their genetic composition. This genetic basis has also been supported through twin research. Identical twins (twins from the same fertilized ovum) have a higher consistency in their timing of first sexual intercourse when compared with fraternal twins (twins from two different fertilized ova) (Dunne et al., 1997; Guo & Tong, 2006). Furthermore, sexual behavior appears to be regulated, in part, by the dopamine receptor subtype (DRD2) in males (Melis & Argiolas, 1995). In their study, Miller et al. (1999) found that the presence of the 2-allele haplotype of the DRD2 gene was related to a later age of first sexual intercourse. Thus, a stronger or earlier appearing sex drive may be the result of the absence of this 2 allele. This association also becomes stronger when the DRD2:2 and DRD1:2 alleles are combined. In sum, it appears that individuals may be genetically predisposed to the initial timing of sexual intercourse.

Depression is also influenced by genetics, in that, it is found to be a familial disorder (i.e., it "runs" in families). Empirical research indicates that the heritability of depression ranges from 35% - 42% (Hallfors et al., 2004; Kendler et al., 2006; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000; Sullivan et al., 2000). Therefore, having a depressed parent or sibling is significantly associated with experiencing depression (Fendrich, Warner, & Weissman, 1990; Lewinsohn, et al., 2000; Reinherz, Paradis, Giaconia, Stashwick, & Fitzmaurice, 2003; Shiner & Marmorstein, 1998).

Sex Differences

Although there are a lot of similarities between males and females regarding sexuality, there are differences between the sexes with respect to coitus. The first difference is the biological timing of sexual prime. Sexual prime refers to the age-related stage where one is at a heightened level of arousal. Males reach their sexual prime at approximately 19 years of age, whereas females reach their sexual prime during their 30s. This sex difference produces an increased interest in sexual intercourse at a younger age for males and an older age for females. Furthermore, adolescent males may be more interested in the physical pleasure involved in intercourse. This interest may be due to the higher likelihood of males experiencing orgasm through penile-vaginal intercourse compared to females, or the higher levels of testosterone that are found in males (Hyde & DeLamater, 1997), or both.

Sex differences in depression typically begin in adolescence (Allgood-Merten et al., 1990; Kessler, 2003; Scourfield et al., 2003; Wade, Cairney, & Pevalin, 2002) between the ages of 13-15 years (Essau, Conradt, & Petermann, 2000; Ge, Conger, & Elder, 2001; Wade et al., 2002) and continue throughout the lifecycle (Cairney & Wade, 2002; Nolen-Hoeksema, Girgus, & Seligman, 1991; Scourfield et al., 2003). These differences are usually more pronounced among older adolescents than among younger adolescents (Kessler, 2003), and among females compared to males. Previous empirical research estimates that females are more likely than males to be depressed at a ratio of 2:1 (Afifi, Enns, Cox, & Martens, 2005; Galambos, Leadbeater, & Barker, 2004; Joyner & Udry, 2000; Lewinsohn, et al., 1999; Nolen-Hoeksema & Girgus, 1994; Roberts,

Roberts, & Chen, 1997). For males, depression manifests itself as irritability, work inhibition, social withdrawal, and sleep disturbance (Baron & Joly, 1988). Adolescent males with depressive symptomatology can be described as being disagreeable, aggressive, and antagonistic (Gjerde, Block & Block, 1988). For females, body image distortion, loss of appetite, weight loss, moodiness, and lack of general satisfaction are prominent depressive symptoms (Baron & Joly, 1988). Adolescent females can be described as "ego-brittle", unconventional, and having ruminating and internalizing characteristics (Gjerde et al., 1988). Finally, female dizygotic twins with depressive symptomatology are more likely to experience greater fatigue, hypersomnia, and psychomotor retardation, whereas male dizygotic twins are more likely to report insomnia and agitation (Khan et al., 2002). Thus, gender differences occur in twins who share the same genetics and social environment. In summary, research suggests that there are sex differences in the expression of depressive symptomatology among male and female teens (Kendler, Myers, & Prescott, 2005), and females are more likely than males to experience depressive symptomatology.

Pubertal Maturity

Among adolescents, pubertal maturity (Halpern et al., 1993; Rosenbaum, & Kandel, 1990; Smith, Udry, & Morris, 1985; Udry & Billy, 1987; Udry, 1988; Whitbeck, Conger, & Kao, 1993) and age at menarche (Phinney, Jensen, Olsen, & Cundick, 1990; Zabin, Smith, Hirsch, & Hardy, 1986) are positively related to the onset of sexual activity. Thus, youth who experience early physical development and/or an early menstrual cycle are more likely to be involved in coitus at an earlier age. Therefore,

those individuals who experience physical maturity earlier in life may also be biologically predisposed to engaging in earlier sexual intercourse.

Empirical evidence also suggests that early pubertal maturity in females places them at an elevated risk for depression (Ge et al., 2001). Thus, females who experience menstruation at an early age are more likely to be involved in sexual intercourse in addition to an increased risk of depression. For males, very early and very late puberty has been associated with an increased likelihood of depression (Kaltiala-Heino, et al., 2003).

Race

African-American adolescent males remain more likely to engage in first sexual intercourse at an earlier age than males of all other races. Furthermore, Black males are approximately 3 to 5 times more likely than males in any other race to have first coitus at a young age. By comparison, Asian American males are the least likely to have earlier coitus (Upchurch, Levy-Storms, Sucoff, & Aneshensel, 1998). As previously discussed, this racial difference may result from a genetic predisposition to earlier coitus.

Certain racial groups also appear to be more affected by depression when compared to other races. For example, it has been found that Black, Asian, and Mexican adolescents are likely to report higher levels of depressive symptomatology when compared to non-Hispanic Whites (Goodman & Capitman, 2000; Roberts et al., 1997). Therefore, race is an important variable in the explanation of earlier sexual intercourse and depressive symptomatology.

Biological Summary

In summary, higher levels of testosterone and dopamine, the presence of the dopamine receptor DRD2, being male, experiencing puberty at an early age, and being Black are related to an increased likelihood of participation in earlier sexual intercourse. Furthermore, a hyperactive hypothalamic-pituitary-adrenocortical axis, low serotonin levels, a depressed relative, being female, early pubertal timing, and being non-White indicate an increased risk for depression. These findings suggest that biology plays an important role in the etiology of both earlier sexual onset and depression. Thus, the explanation for the relation between early first intercourse and depression may lie in some of the underlying biology of these phenomena. For example, common genetic factor may underlie both an early intercourse and proneness to depression. However, a large portion of the variance in coitus and depression remains unexplained by biology alone. Thus, over the next few pages, I examine the psychological and sociological determinants of both coitus and depression among adolescents.

Psychological Determinants of Adolescent Sexual Intercourse and Depression

In this next section, impulsivity, self-esteem, and social support will be addressed as psychological determinants of both early sexual intercourse and depression among youth.

Impulsivity

Temperament, character, and what one acquires through learning is said to constitute personality. Temperament refers to the genetic aspect of an individual's personality (e.g., introversion or extraversion), whereas, character involves the cognitive

processes provoked by temperament (Matsudaira & Kitamura, 2006). Thus, it is a joint contribution of one's biological and psychological attributes that constitute personality. Empirical evidence suggests that those individuals whose character is highly impulsive are more likely to be involved in sexual intercourse at an earlier age (Kahn et al., 2002; White & Johnson, 1988). Perhaps, individuals who are highly impulsive may be more spontaneous, and thus, be more likely to engage in earlier coitus for the increase adrenaline that accompanies coitus.

Research indicates that certain personalities are also more likely to suffer from depression. It is suggested that extraversion (Clark, Watson, & Mineka, 1994; Kendler et al., 2006; Kirkaldy & Siefen, 1998) and impulsiveness (Kahn et al., 2002; Kosunen, Kaltiala-Heino, Rimpela, & Laippala, 2003) may predispose persons to depression (Kendler, Karkowski, & Prescott, 1999). Thus, some personality types may be more susceptible to depression. Perhaps, individuals who are extrinsically motivated may be more likely to seek the approval of others, and thus, may be at risk for psychological distress if they are not successful in gaining the approval of others. In summary, there appears to be a liability to both depression and earlier coitus with higher levels of impulsivity.

Self-Esteem

High levels of self-esteem in young males and young females have been associated with participation in earlier and more frequent sexual intercourse (Kowaleski-Jones & Mott, 1998; Miller, Christensen, & Olson, 1987; Spencer, Zimet, Aslsma, & Orr,

2002). As a result, it has been suggested that teens may attempt to bolster their self-esteem through sexual intercourse (Hajcak & Garwood, 1988).

Low self-worth (Franko et al., 2005), low body self-esteem (Allgood-Merten et al., 1990), and high self-consciousness (Lewinsohn, Gotlib, & Seeley, 1997) have been associated with depression. Thus, it is not surprising that a greater number of females than males struggle with low levels of self-esteem and higher levels of depressive symptomatology. As previously mentioned, females experience depression at a ratio of 2:1 when compared to males. In sum, higher levels of self-esteem have been associated with both earlier sexual intercourse and lower levels of depressive symptomatology. Thus, this thesis will include self-esteem as a variable to be tested in the final analyses.

Social Support

Close friends play a significant role in sexual behavior among teens by providing social norms that detail acceptable sexual practices (Harper, Gannon, Watson, Catania, & Dolcini, 2004). Therefore, a teenager is more likely to be sexually active if his/her close friends are sexually active (Sieving, Eisenberg, Pettingell, & Skay, 2006).

Furthermore, low levels of social support are also linked to higher levels of depressive symptomatology in males and females during adolescence (Hazler & Mellin, 2004; Schraedley, Gotlib, & Hayward, 1999). Even a lack of social support in the form of poor peer or family relationships is a risk factor for depression (Galambos et al., 2004; Greenberger, Chen, Tally, & Dong, 2000; Lewinsohn, et al., 2000). Research indicates that low levels of social support are associated with lowered physical and psychological well-being (Cohen, 1988). Therefore, it is not surprising that Kendler et al. (2005) found

that emotionally supportive social relationships protected against major depression. Thus, a supportive social group is beneficial to mental health.

Psychological Summary

In summary, there are psychological variables that are related to both earlier sexual intercourse and depressive symptomatology among youth. The association between impulsivity, self-esteem, and social support were discussed in the previous psychological section. It was found that earlier teen intercourse was associated with impulsivity, higher levels of self-esteem, and having friends that are sexually active. Depression among adolescents was associated with impulsivity, lower self-esteem, and lower levels of social support. However, due to the lack of a valid measure of personality or impulsivity in the Add Health, impulsivity was not included in the final analyses.

Sociological Determinants of Adolescent Sexual Intercourse and Depression

Finally, to complete Engel's biopsychosocial model, I will address the sociological determinants of earlier coitus and depression among youth in this section. Individuals are affected by their genes, their personalities, as well as the people around them. Parenting styles, life experiences, geographic location, social mores, and norms all account for the unique environmental experience of an individual. A closer look at the sociological influences on depression and sexual intercourse can assist in explaining the effect that the social environment has on coitus and depression.

Socioeconomic Status

Socioeconomic status (SES) refers to one's position in the hierarchy of society based on occupation, household income, and education. Parental education and income is

generally used as a proxy when assessing SES status of children and youth. It has been found that both low parent education and low household income are associated with an earlier onset of sexual activity (Santelli, Lowry, Brener, & Robin, 2000). That is, those children born into a lower SES are more likely to engage in coitus at a younger age.

Low SES (Goodman, Slap, & Huang, 2003; Rao et al., 1995), including low parental education (Franko et al., 2005), has been shown to be associated with depression and recurrence of depression among adolescents. Youth who live in households marked by lower incomes and low parental education often report higher levels of depressive symptomatology (Goodman & Capitman, 2000). Thus, it appears that adolescents characterized by lower SES are more likely to engage in earlier sexual intercourse and to experience depressive symptomatology.

Stressful Life Events

Negative life events occurring during childhood and adolescence can place an increased amount of stress on an individual. Stressful life events, such as being raised in single parent families, have been associated with earlier initiation of sexual intercourse in adolescents (Hayes, 1987). In addition, those individuals who have been exposed to childhood sexual abuse have a greater likelihood of participating in coitus during adolescence (Fergusson, Horwood, & Lynskey, 1997).

Stress induces the "fight or flight" response that is used to protect the organism from harm. However, uncontrollable and repetitive stress can contribute to and exacerbate pathologies, such as depression (Allgood-Merten et al., 1990; Ge et al., 2001; Lewinsohn, et al., 2000). Thus, in addition to the association between stressful life

events and earlier coitus, there also appears to be a relationship between stressful life events and depression. In 2002, Pine, Cohen, Johnson, and Brook identified stressful life experiences in adolescence as a risk factor for major depression during early adulthood. Events such as parental loss (Kendler, Sheth, Gardner, & Prescott, 2002) and physical and sexual abuse in childhood were significant stressful events that have been associated with future depression in both males and females (Reinherz et al., 2003; Schraedley et al., 1999). Thus, stressful life events can influence or exacerbate one's depressive symptomatology.

Religious Involvement

Premarital sex is, for the most part, discouraged in most religious institutions today. Thus, many religious institutions often promote abstinence. As a result, it is logical that empirical research has found a negative association between church attendance and the onset of sexual activity among adolescents (Day, 1992; Miller et al., 1987). Therefore, those young people who attend religious ceremonies regularly are less likely to be sexually active (Doss et al., 2006; Thornton, & Camburn, 1989; Woodroof, 1985).

Past research has also found an inverse association between psychopathology and religious involvement (Kendler et al., 2003). In 1993, Wright, Frost, and Wisecarver found that an increased frequency of religious involvement including positive views of religion were associated with lower depressive symptomatology for both males and females. Thus, a higher religious involvement appears to be associated with lower levels of depression and a lower likelihood of coitus.

Sociological Summary

In summary, there are sociological variables that are related to both earlier sexual intercourse and depressive symptomatology among adolescents. The association between socioeconomic status, stressful life events, religious involvement, coitus and mental health were discussed in the previous sociological section. It was found that earlier teen intercourse was associated with lower SES, certain stressful life events, and a lower involvement in religion. Depression among adolescents was associated with lower SES (specifically, lower parental income and low parental education), a higher level of stressful life events, and lower levels of religious involvement.

Review

Depression is a complicated mental illness that has been documented to begin to manifest generally in adolescence and early adulthood (Robins, Locke, & Regier, 1991). Those adolescents who are affected by depression know of its mental agony and destructive side effects. Past research suggests that there may be a link between depression and coitus, in that, those adolescents who have earlier sexual intercourse may be more likely to experience subsequent depression. However, two recent articles have argued that depressive symptomatology predicts earlier sexual intercourse. Thus, the temporal ordering of genital union and mental health may be more complicated than previously suggested. Since sexual exploration often exists as part of the adolescent experience, it is important to determine any possible effects that earlier intercourse may have on the mental health of teens.

Currently, it is unclear whether earlier coitus is predictive of depression, or if there is a relationship between biopsychosocial factors that are predictive of both depression and sexual intercourse. To assess this, a biopsychosocial framework (Engel, 1977) will be utilized to examine various determinants that have been identified as predictors of *both* sexual behavior and depression. This model will assess biological determinants including age, sex, pubertal maturity, and race; psychological determinants including self-esteem and social support; and sociological determinants including socioeconomic status (comprised of household income and parental education) and religious involvement. The biopsychosocial model provides an excellent frame of reference for the relationship between depression and coitus, in that, biological, psychological, and sociological variables have been previously found to predict both depression and early participation in sexual intercourse. However, even though coitus is often a part of the adolescent experience, previous research suggests that those teens that participate in earlier sexual intercourse may be predisposing themselves to poor mental health and the possibility of a lifetime of mental illness (Hallfors et al., 2005; Hallfors et al., 2004; Kaltiala-Heino et al., 2003; Kosunen et al., 2003; Kowaleski-Jones & Mott, 1998; Shrier, Harris, Sternberg, & Beardslee, 2001). Since empirical evidence suggests that involvement in sexual intercourse during adolescence may put youth at risk for mental illness, depression may be an additional cost associated with earlier adolescent sexual intercourse.

Research Questions

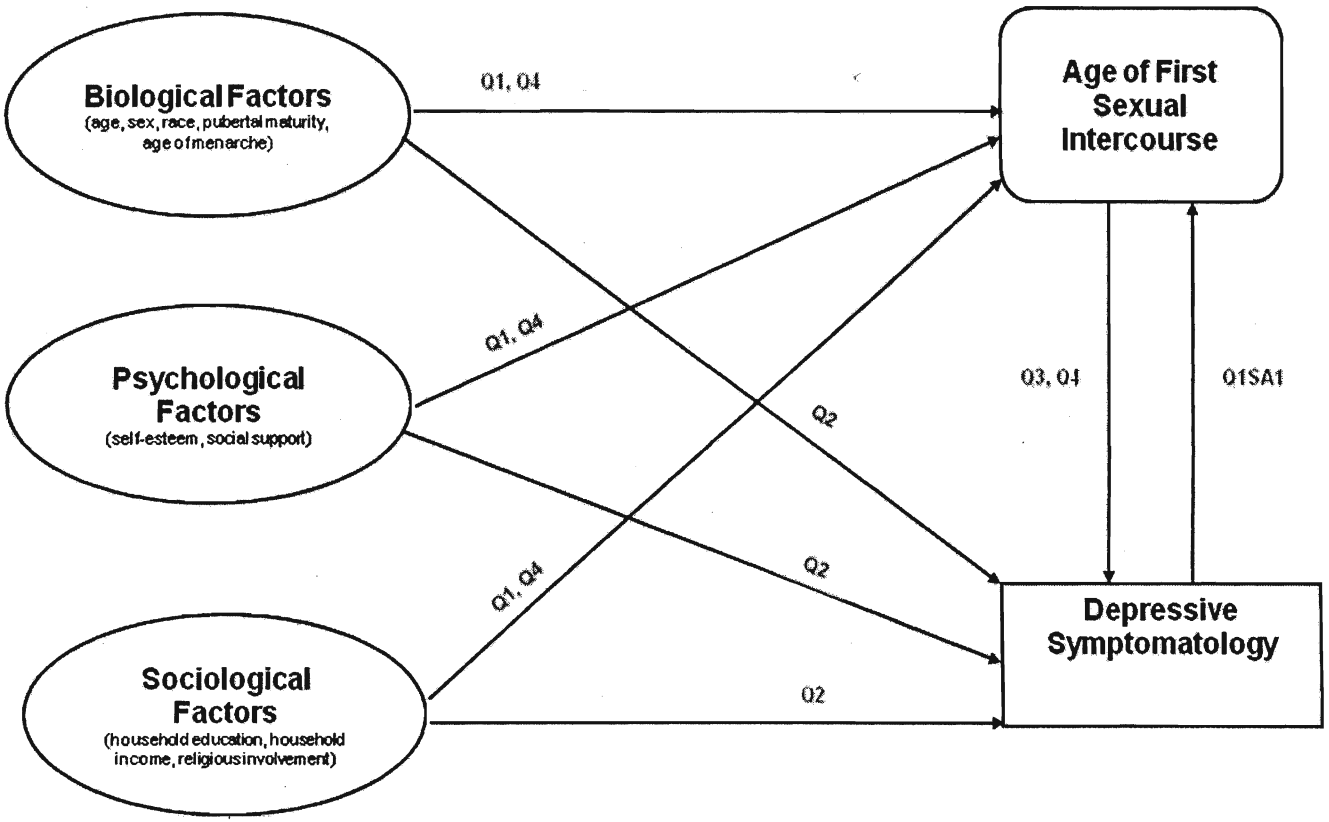
While four of the six articles reviewed in this thesis suggested that earlier sexual intercourse may predict subsequent depression, their results are equivocal and have various limitations. These limitations include the use of cross-sectional data, longitudinal results that are separated by one or two years, the lack of a definition of sexual intercourse, use of one-item from a multi-item scale to analyze depression, and insufficient data on what represents "early" sexual intercourse. This thesis will attempt to address these limitations. Moreover, it will incorporate a biopsychosocial framework to examine the relationship between early onset penile/vaginal sexual intercourse of adolescents and depressive symptomatology as they enter into adulthood, accounting for biological, psychological, and sociological factors.

The ambiguous findings in previous literature in the temporal ordering of first sexual intercourse and depression indicate a problem in deciphering the sequential ordering between them. While the majority of the research indicates that early onset of sex precedes depression, others have identified the reverse pathway as plausible. These equivocal findings suggest that the relationship may be spurious, as both may be explained by biological (age, sex, pubertal maturity, race), psychological (self-esteem, social support), and sociological determinants (socioeconomic status, religious involvement). That is, early coitus and depression may be multiple concomitant outcomes of the biopsychosocial process. Therefore, this thesis also examines the temporal ordering between depression and first sexual intercourse in adolescents within a

biopsychosocial framework. The following research questions summarize the approach taken in this thesis. They are presented in Figure 2.

1. Do biological, psychological, and sociological factors at Wave I predict an earlier age of first sexual intercourse (Waves I, II, or III)? (Figure 2, Q1)
    - Does a higher level of depressive symptomatology at Wave I predict an earlier age of first sexual intercourse (Waves I, II, or III)? (Figure 2, Q1SA1)
2. Do biological, psychological, and sociological factors in Wave I predict higher levels of depressive symptomatology (and an increase in depressive symptomatology) in Wave III? (Figure 2, Q2)
3. Does an earlier age of first sexual (Waves I, II, or III) intercourse predict higher levels of subsequent depressive symptomatology (and an increase in depressive symptomatology) at Wave III? (Figure 2, Q3)
4. After controlling for biological, psychological, and sociological factors at Wave I, does earlier age of first sexual intercourse (Waves I, II, or III) predict higher levels of depressive symptomatology (and an increase in depressive symptomatology) in Wave III? (Figure 2, Q4)

Figure 2


Biological Factors
(age, sex, race, pubertal meturity, age of menarche)
Psychological Factors
(self-esteem, social support)
Sociological Factors
(household education, household income, religious involvement)
Age of First Sexual Intercourse
Depressive Symptomatology
Q1, Q4
Q1, Q4
Q1, Q4
Q2
Q2
Q2
Q3, Q4
Q1SA1

CHAPTER 3: METHODS

Using the National Longitudinal Study of Adolescent Health (Add Health) restricted data set release 2 (Udry, 2003), I analyzed the depressive symptomatology of adolescents over a seven-year time period. Collected by Richard Udry and his associates at the Center for Health Statistics Research in North Carolina, the Add Health explores the causes of health-related behaviors with an emphasis on the social context. To date, it is the largest and most comprehensive longitudinal survey of youth to examine the social dimensions of development from adolescence through to adulthood (Udry et al., 2003).

The Add Health is a nationally representative, school-based, longitudinal study of adolescents who were in grades 7 through 12 in the United States (including Alaska and Hawaii) in the 1994-1995 academic school year. Data were collected from the students, parents, and school administrators in the 1994-1995 academic year (Wave I), and from the adolescents in the 1995-1996 academic year (Wave II). A third wave of data was collected from the respondents, as young adults, again in 2001-2002 (Wave III). The study protocol was approved by the University of North Carolina Institutional Review Board on Research Involving Human Subjects.

Sample Characteristics

Wave I

Wave I data collection was conducted from September 1994 to December 1995. Schools were chosen based on a nationally stratified probability sampling strategy proportional to school size. Of the original 26,666 schools across the continental United States of America, a stratified random sample of schools were selected which included 80

high schools and 52 of their affiliated middle (feeder) schools. Schools were clustered by region (Northeast, Midwest, South, West), urbanicity (urban, suburban, rural), size (125 or fewer, 126–350, 351–775, 776 or more students), school type (public, private, parochial), percent white (0, 1–66, 67–93, 94–100), percent black (0, 1–6, 7–33, 34–100), grade span (Kindergarten–12, 7–12, 9–12, 10–12), and curriculum (general, vocational/technical, alternative, special education). The sample was stratified by region (West, Midwest, South, and Northeast) and clustered by school identification (n=132) to accommodate the sampling of the Add Health. Thus, students were randomly sampled from schools and regions to provide generalizable results. The final sample utilized in this thesis was stratified as follows: (West, n=1,448; Midwest, n=1,833; South, n=2,346; Northeast, n=883).

Test Administration

In-school questionnaire. All students in the selected schools (N=90,118) were given the In-School questionnaire. In-School questionnaires were self-administered paper-and-pencil surveys that took approximately 45-60 minutes of class time to complete.

In-home interviews. A stratified, random sample of students who had completed the In-School questionnaire (unweighted N=20,774) were interviewed in their home (see Table 1). African-Americans, Chinese, Cuban, Puerto Rican, and disabled adolescents were over-sampled to provide better estimates for these specific subpopulations. Written informed consent to participate in the study was obtained from the parent or legal guardian and from the adolescent. Adolescent respondents filled out questionnaires on a

laptop computer and responded to interview questions given by the interviewer. Interviewers entered less sensitive material on a laptop, with interview sessions lasting between 60 to 120 minutes in length. Sensitive questions (on topics such as sexual activity and depressive symptomatology) were entered by the students themselves using an audio computer-assisted self interview (A-CASI) device. This device allowed subjects to enter responses to audio (on a tape with earphones) and visual (on a screen) questions. The A-CASI interview technique has been shown to increase the validity of sensitive question reporting (Supple, Aquilino, & Wright, 1999) while maximizing confidentiality, improving authenticity (Turner et al., 1998), and reducing missing data (Hallfors, Khatapoush, Kadushin, Watson, & Saxe, 2000). The A-CASI also assists in the reduction of interviewer or social desirability bias. The reduction of interviewer and social desirability bias is important in this thesis due to the sensitivity of the topic. Therefore, by using the A-CASI, there will be increased confidence in the validity of the results presented in this study. Thus, results will reflect actual experiences of the respondents.

Table 1

Add Health Sample Statistics

Sample	Wave I	Wave II	Wave III	Final Longitudinal Sample
Unweighted Sample	20,774	14,738	15,170	10,828
Weighted Sample	18,924	13,568	14,322	6,510

Parent interviews. In addition to the In-Home student interviews, parents were also administered an In-Home interview. Parent interviews lasted approximately 40 minutes and were administered by an interviewer using a paper-and-pencil instrument that was optically scanned. There was an 85.27% response rate among the parent or guardians of the students who participated in the In-Home interview. A total of 17,713 parents (unweighted *N*) completing child-specific questions and 17,669 (unweighted *N*) parents answering parent-specific questions. Families were not given an incentive for their participation.

Wave II

Wave II In-Home interviews were conducted approximately one year later between April and August 1996. This Wave consisted of 14,738 (unweighted *N*) of the original Wave I respondents. The decision by the original investigative team was made not to re-interview those respondents who left school (graduated or dropped out) in Wave II. Of the 14,738 respondents, there was a 70.94% response rate from the Wave I In-Home student survey. The majority of the sample loss was due to the decision not to follow respondents in Wave II who left school or graduated. The testing procedures for the student In-Home interviews remained the same for Wave II as in Wave I. However, in Wave II, parents were not re-interviewed.

Wave III

From August 2001 to April 2002, all original Wave I respondents who could be located (now 18-26 years old), including those who were not followed up in Wave II, were re-interviewed. In-Home interviews were conducted on a total of 15,170

(unweighted *N*) of the original Wave I respondents resulting in a 73.02% follow-up from Wave I. The Wave III questionnaire retained some content from previous Waves and included new sections that focused on topics relevant to young adults. Additional sections obtained information on their recent relationship, marital, childbearing, and educational histories. All data were entered on laptop computers instead of paper questionnaires to maintain confidentiality. The respondents entered sensitive material in private. Less sensitive material was entered by the interviewer during the interview. The average interview lasted 134 minutes; 90 minutes for the laptop interview followed by a collection of saliva and urine specimens.

In an effort to ensure the representativeness of the sample to the U.S. population of adolescents, sample weights were calculated and attached to each respondent at each Wave proportional to the number of persons in the population that each specific person represented. The sample weights were recalculated over Waves to account for over-sampling specific subpopulations, and attrition and loss due to follow-up of cases to ensure each cross-sectional Wave was again representative of the population. These grand sample weights were applied to the data to provide estimates generalizable to the U.S. adolescent population and ensure unbiased estimates (Tourangeau & Shin, 1998). Finally, a longitudinal sample weight was calculated to ensure the longitudinal sample was representative of the population adjusting for any differential attrition and loss due to follow-up across the three Waves.

Measures

Dependent Variable

Depressive Symptomatology

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; herein referred to as the DSM), depression is a mood disorder that is usually maladaptive and is characterized by feelings of extreme gloom and sadness (APA, 2000). A clinical diagnosis of depression or dysthymia is given by a Psychiatrist, Psychologist, or medical Doctor through the use of a checklist of symptoms, behaviors, and moods using the DSM or a diagnostic algorithm such as the Structured Clinical Interview for DSM-IV (SCID), the Diagnostic Interview Schedule for DSM-IV (DIS-IV), or the Composite International Diagnostic Interview (CIDI). This study does not permit for the identification of depression as a psychiatric diagnosis based on the DSM; it does, however, provide an opportunity to examine depressive symptomatology and change in depressive symptomatology.

Depressive symptomatology refers to a state of general unhappiness and is gathered through the use of psychometric instruments, such as the Beck Depressive Inventory (BDI) and the National Institute of Mental Health Centre for Epidemiologic Studies-Depression Scale (CES-D). These instruments ask specific questions targeting symptoms, behaviors, and moods that are characteristic of depression. It can be said that a person has a 'high' or 'low' level of depressive symptomatology based on the use of these instruments. Thus, for this thesis, depression or depressive symptomatology refers to a varying state of unhappiness based on the level of depressive symptoms.

Depressive symptomatology was consistently assessed in all three Waves of the Add Health utilizing 8 items of the 20-item CES-D Scale (See Appendix A). Developed by Radloff in 1977, the CES-D assesses current levels of depressive symptomatology by asking the respondent to rate depressive symptoms over the last week. The CES-D was developed to be standardized for epidemiological studies and high school populations (Radloff, 1991), and, as such, it is a valid measure to be utilized in this thesis for assessing adolescent depressive symptomatology. For each item, respondents were asked to report how often in the last seven days they had experienced depressive symptoms. Response choices were 0 (never or rarely), 1 (sometimes), 2 (a lot of the time), and 3 (most of the time or all of the time). Two of the 8 items assessed positive feelings ("you felt that you were just as good as other people" and "you enjoyed life") and were reversed coded for scale construction and analyses. To create the measure of depressive symptomatology utilized in this thesis, all 8 CES-D items were summed across each Wave. Scores on the shortened version of the CES-D ranged from 0 to 24, with higher values on this scale representing higher levels of depression. A factor analysis using the maximum likelihood method with a principal components solution and a varimax rotation solution was conducted and verified that these 8 items demonstrated similar factor structures to previous analyses (Radloff, 1977; Roberts, Andrews, Lewinsohn, & Hops, 1990) (see Tables 2-4).

For respondents who did not answer one or more of the CES-D items for any Wave, a respondent-based mean substitution technique was employed using the individual's responses to items (Anderson, Basilevsky, & Hum, 1983). Respondents who

Table 2

Factor Analysis of Depressive Symptomatology Items at Wave I

	Depressive Symptomatology	Principal Component		Varimax Rotation	
		Factor 1	Factor 2	Rotated Factor 1	Rotated Factor 2
Variable Names	Felt depressed	0.81*	-0.14	0.79*	0.23
	Felt sad	0.76*	-0.13	0.74*	0.21
	Had the blues	0.76*	-0.18	0.76*	0.17
	Bothered by things	0.65*	-0.23	0.68*	0.08
	Trouble keeping mind focused	0.57*	-0.24	0.62*	0.03
	Enjoyed life	0.57*	0.50	0.29	0.70*
	Felt people dislike you	0.55*	0.06	0.47	0.30
	You are just as good as others	0.40	0.77*	0.03	0.87*
Total number of items	8	7	1	5	2
Variance Explained by Each Factor		3.348	1.031	2.907	1.472
Cronbach's Alpha (Standardized)	0.791				

Table 3

Factor Analysis of Depressive Symptomatology Items at Wave II

	Depressive Symptomatology	Principal Component		Varimax Rotation	
		Factor 1	Factor 2	Rotated Factor 1	Rotated Factor 2
Variable Names	Felt depressed	0.81*	-0.11	0.77*	0.27
	Felt sad	0.77*	-0.09	0.73*	0.27
	Had the blues	0.77*	-0.17	0.76*	0.20
	Bothered by things	0.65*	-0.25	0.69*	0.07
	Trouble keeping mind focused	0.57*	-0.32	0.66*	-0.02
	Enjoyed life	0.57*	0.51	0.28	0.71*
	Felt people dislike you	0.55*	0.06	0.46	0.30
	You are just as good as others	0.41	0.76*	0.02	0.86*
Total number of items	8	7	1	5	2
Variance Explained by Each Factor		3.387	1.053	2.908	1.532
Cronbach's Alpha (Standardized)	0.795				

Table 4

Factor Analysis of Depressive Symptomatology Items at Wave III

	Depressive Symptomatology	Principal Component		Varimax Rotation	
		Factor 1	Factor 2	Rotated Factor 1	Rotated Factor 2
Variable Names	Felt depressed	0.82*	-0.12	0.79*	0.25
	Felt sad	0.78*	-0.18	0.78*	0.18
	Had the blues	0.78*	-0.12	0.75*	0.23
	Bothered by things	0.67*	-0.21	0.70*	0.10
	Trouble keeping mind focused	0.61*	-0.24	0.65*	0.05
	Enjoyed life	0.62*	0.52	0.33	0.74*
	Felt people dislike you	0.51	-0.09	0.50	0.14
	You are just as good as others	0.45	0.77*	0.06	0.89*
Total number of items	8	6	1	5	2
Variance Explained by Each Factor		3.546	1.045	3.067	1.524
Cronbach's Alpha (Standardized)	0.811				

had missing data on less than 30% of items for the scale in a specific Wave were assigned the average score of the remaining items of the scale in that Wave. Those who were missing more than 30% of the items were deleted from the analysis. The use of respondent-based mean substitution technique assumes that the mean across the items that the respondent answered is representative of the average of all items in the scale. This technique is preferable to a sample mean substitution technique because it does not assume that each case can be adequately represented by the mean of all respondents. Furthermore, this substitution strategy is preferable to a sample mean substitution technique because it does not artificially reduce the variance of the sample (Anderson et al., 1983).

Age of First Sexual Intercourse

The Add Health defined sexual intercourse and vaginal intercourse as "male/female penile-vaginal intercourse". Sexual intercourse was assessed in Waves I and II by the question, "Have you ever had sexual intercourse?", and in Wave III by the question, "Have you ever had vaginal intercourse?". Those respondents who answered 'yes' to these questions were further prompted as to when this intercourse occurred.

In Waves I and II, age of first coitus was assessed by the question, "In what year did you have sexual intercourse for the very first time?". Next, in this study, the respondent's year of birth was subtracted from the reported year of first sexual intercourse to provide an age of first coitus. For Wave III, age of first sexual intercourse was assessed by the question, "How old were you the first time you had vaginal intercourse". Based on these questions and calculations, age of first sexual intercourse

was a self-reported continuous variable coded in years. All three Waves were used to identify age of first sexual experience because during Waves I and II, many respondents, especially the younger ones, had reported never having sexual intercourse. As such, Wave III provided an opportunity to minimize any missing data due to right-hand censoring, since all respondents were at least eighteen by this time and most had reported a first sexual experience involving coitus by this time.

Furthermore, age at first sexual intercourse was coded so that if a respondent did not provide data for this variable in one Wave, their response from the subsequent Wave was utilized. For example, if there was missing data for age of first sexual intercourse in Wave II, then the respondent's answer from Wave III was used. Furthermore, if any two Waves had missing data for age of first sexual intercourse, then the remaining Wave was used to provide the age of first intercourse. In some instances, when responses by one respondent over multiple Waves to these questions were contradictory, a decision was made to utilize their response from Wave III. The logic behind this decision was that, although their first sexual intercourse could more easily be recalled at a younger age, the respondents may have confused anal or oral sex for vaginal/penile sexual intercourse. Moreover, there is less likelihood of exaggerated responses among the respondents when they were older, and, as such, may provide a more accurate date of first coitus. Therefore, by using the third Wave of the Add Health, the respondent would be more likely to understand vaginal/penile sexual intercourse, and as a result, would not create a false positive response.

Two exclusions for this variable included age of sexual intercourse prior to 11

years of age and same-sex intercourse. Sexual intercourse before 11 years of age is considered by law to be non-consensual and would likely represent a forced sexual intercourse experience. Since childhood sexual abuse is associated with later depression (Molnar, Buka, & Kessler, 2001), the inclusion of respondents who had experienced sexual abuse would bias the research results. Thus, those participants who reported having sexual intercourse at ≤10 years of age were deleted from all analyses.

Finally, due to the independent associations for same-sex attraction and depression, the present thesis did not include sexual intercourse with same-sex partners. Respondents (n=71) who identified as homosexuals ("100% homosexual"; "mostly homosexual, but somewhat attracted to people of the opposite sex") or asexuals ("not sexually attracted to either males or females"; see Bogaert, 2004, 2006, 2008 for a comprehensive overview) were removed from analyses.

In sum, age of first vaginal intercourse was computed by subtracting the reported age of first coitus (Waves I, II, and III) from the corresponding year in which the respondent was born (Waves I, II, and III). This new variable was then assessed across Waves to determine if the respondent reported a consistent age of first sexual intercourse over time. When there was a discrepancy between Waves on the reported age of first coitus, the respondent's Wave III answer was utilized. Age of first sexual intercourse for the final sample ranged from 11-25 years of age. Self-report of sexual behavior has been shown to be consistent with actual behavior (see Alexander, Somerfield, Ensminger, Johnson, & Kim, 1993), indicating the accuracy in self-reporting. Therefore, although

age of first sexual intercourse was a self-reported item in this study, previous research indicates that confidence can be placed in this item.

Independent Variables

Biological Variables

Age. Age was coded by year and was calculated during Wave I by subtracting the date of birth from the date that the first interview was completed. The age range for adolescents in this thesis in Wave I was 11 to 21 years.

Sex. Sex was a self-reported variable that was confirmed by the interviewer (by asking if necessary), where 1=male and 2=female. This variable was then recoded so that males were the referent group (male=0, female=1). The final sample included 3,297 females and 3,213 males.

Pubertal maturity. In Wave I, relative physical development was assessed in relation to other adolescents. Respondents were asked, "How advanced is your physical development compared to other girls/boys your age?". Responses ranged from 1=younger than most to 5=older than most. Since pubertal maturity was based on subjective self-report, an objective measure of maturity (age of menarche) was added to the analysis.

Age of Menarche. The Add Health provided an objective measure of maturity for females but not males. Thus, a conditionally relevant variable was created to allow the examination of age of menarche for females while maintaining males in the analysis. Menarche was assessed at Wave I by the question, "How old were you when you had your very first menstrual period?". The sample mean age of first menstrual cycle

($\overline{X}$=12.0854892) was then subtracted from the respondent's age of first menstruation. To include males, each male subject was given a value of 0 for this variable. As a result, menarche ranged from -5.085 to 4.915 for the final sample, centering around the mean of 0 (see Table 5).

Race. Race was based on respondents' self-report at Wave I. Respondents were asked to identify their race based on the following five options: White, Black or African American, American Indian or Native American, and Asian or Pacific Islander. Each answer was dichotomized as 1=yes, and 0=no. Race was then recoded into 4 dichotomous variables with White as the referent group.

Psychological Variables

Self-esteem. Self-esteem was determined by six items from a 5-point Likert scale that ranged from strongly agree to strongly disagree in Wave I. These items are a subset of Rosenberg's Self-Esteem Inventory, a measure of global self-esteem (Rosenberg, 1965). Questions included, "You like yourself just the way you are" and "You have a lot to be proud of" (see Appendix B). Answers were reverse coded so that they ranged from 6 to 30 with higher values representing higher levels of self-esteem. A confirmatory factor analysis, using the maximum likelihood method with varimax rotation, indicated that the six items represented a single factor (see Table 6). The scale was built by summing all six items and utilizing the same missing value algorithm described previously for the CES-D. For analysis, this scale was examined as a continuous measure.

Table 5

Descriptive Statistics for Age of Menarche

Value	Unweighted		Weighted	
	Frequency	Percent	Frequency	Percent
-5.0855	5	0.08	2.97	0.04
-4.0855	9	0.14	7.63	0.11
-3.0855	106	1.63	101.83	1.52
-2.0855	253	3.89	214.17	3.20
-1.0855	674	10.35	654.60	9.79
-0.0855	1073	16.48	1051.16	15.71
0	3213	49.35	3529.74	52.77
0.9145	819	12.58	799.29	11.95
1.1945	279	4.29	260.51	3.89
2.9145	66	1.01	58.02	0.87
3.9145	12	0.18	9.21	0.14
4.9145	1	0.02	0.20	0.00

Note: Data from Wave I of the Add Health was used to construct the age of menarche variable
n=6,510

Table 6

Factor Analysis of Wave I Self-Esteem Items

		Principal Component
	Self-Esteem	Factor 1
Variable Names	Have a lot to be proud of	0.80*
	Feel loved and wanted	0.77*
	Like self as you are	0.76*
	Feel socially accepted	0.74
	Do everything just right	0.73
	Have lots of good qualities	0.73
Total number of items	6	3
Variance Explained by Each Factor		3.425
Cronbach's Alpha (Standardized)	0.849	

Social support. This variable was assessed based on response to the following questions in Wave I: "How much do you feel that adults care about you?"; "How much do you feel that your teachers care about you?"; "How much do you feel that your parents care about you?"; "How much do you feel that your friends care about you?" and "How much do you feel that people in your family understand you?". Responses ranged from 1=not at all to 5=very much. Social support items were summed to create a measure of social support ranging from 5 to 25, with increasing values indicating higher social support. The same missing value algorithm was employed in the construction of this measure as in the previous scales.

Sociological Variables

Socioeconomic status. The following questions about household income and parental education assessed socioeconomic status (SES) and were asked of each parent or parental figure(s) in Wave I: "About how much total income, before taxes did your family receive in 1994? Include your own income, the income of everyone else in your household, and income from welfare benefits, dividends, and all other sources." Household income ranged from 0-999 in thousand dollar increments. For analysis, income was divided by 1000 so it ranged from 0 to 999, and was examined as a continuous variable.

Household education was assessed by the questions, "How far in school did you go?" and "How far did your current (spouse/partner) go in school?". Answers ranged from 1=never went to school to 10=professional training beyond a four-year college or university degree. To assess household education, the highest education obtained by

either the respondent's mother or father was utilized. For example, if a respondent's mother had a higher educational background than his/her father, the mother's level of education was used as the household education variable. In the case of single-parent households, the lone parent's education was used. A series of dummy variables were created to compare each category of education to the reference category, "Graduated from a College or University". The levels of this variable are as follows: Eighth (eighth grade or less); nohigh (more than eighth grade, but did not graduate from high school); trade (went to a business, trade, or vocational school instead of high school); high (high school graduate); GED (completed Graduate Equivalent Diploma); tradetwo (went to a business, trade, or vocational school after high school); nocollege (went to college, but did not graduate); univ (graduated from a college or University); and grad (professional training beyond a 4-year college or university degree).

Religious Involvement. Religious involvement was measured based on the response to the Wave I question, "In the past 12 months, how often did you attend religious services?". Potential responses included "once a week or more" (churchweek), "less than once a month" (churchmonth), "randomly" (churchrandom) and "never". A series of 3 dichotomous variables were created to compare each type of religious involvement to 'never' go to religious services as the referent group.

CHAPTER 4: ANALYTIC STRATEGY

To determine the relationship of the biopsychosocial variables of interest on depressive symptomatology and early sexual intercourse, secondary data analysis was conducted on Wave I (1994-1995), II (1996), and III (2001-2002) of the Add Health data set. To date, the third Wave of the Add Health has not been examined with respect to coitus and depressive symptomatology.

All statistical analyses were performed using SAS version 9.1. Since the Add Health was intended to be nationally representative of the population of the United States, longitudinal sample weights were applied to the data to provide estimates generalizable to the U.S. adolescent population and ensure unbiased estimates. Weights ensure that estimates produced during analysis are representative of the American population and not just the sample itself. To do this, weights were given to each respondent, which corresponds with the number of people in the entire population that he or she represents.

In addition, all tests of significance employed a specific regression technique in SAS (PROC SURVEYREG) to correct for the complex sample design. Ordinary Least Squares regression (OLS) is based on the assumption of a simple random sample (SRS) in the calculation of the standard error of the estimate. However, in the case of a complex sample design, this assumption is not valid and the sample design must be accounted for in any estimation of the standard error of the estimate. The SAS SURVEYREG procedure takes into account the clustering in the sample and the longitudinal weighting to maintain unbiased estimates and standard errors in a way recommended by the originators of the data (see Chantala & Tabor, 1999).

Univariate Descriptive Analyses

Frequencies were conducted on all variables in the analysis to examine the sample distribution and to identify cases with missing values. The results are presented in Table 7. With the exception of the individual-mean substitution algorithm for depressive symptomatology, self-esteem, and social support, cases with missing and out-of-range values were recoded as missing and deleted from further analysis. From the original core sample (N=20,774), the final weighted sample of (n=6,510) respondents from Wave I, II, and III was utilized for analysis. The final sample excluded those respondents with missing data, and was comprised of 60.12% of the 10,828 unweighted 3-Wave longitudinal sample. The number of missing cases from this unweighted 3-Wave longitudinal sample included (n=2,748) cases deleted due to exclusionary criteria for age of first coitus, (n=303) cases deleted due to same sex or asexual preference, and (n=13,961) cases deleted for missing data across any of the variables of interest.

Table 7 displays the frequencies of the adolescent sample. Those respondents who classified themselves as White represented 70.54% of the final sample (n=4,592), while Blacks comprised 20.35% of the final sample (n=1,325). Native Americans had the lowest frequency (n=233), representing 3.58% of the sample, followed by Asians (n=360; 5.53%). Males comprised 49.35% of the final sample (n=3,213), while 50.65% of the final sample (n=3,297) were female respondents. The mean age of the sample was 15.601 years (SD=1.586) (see Table 8). Adolescents' ages ranged from 12 to 21 in Wave I, with the highest frequency of respondents (n=1,537; 23.61%) being seventeen years of

Table 7

Descriptive Statistics of the Wave I Adolescent Sample

Variable	Unweighted		Weighted	
	Frequency	Percent	Frequency	Percent
Sexually Active				
No	3965	60.91	4238.01	63.35
Yes	2545	39.09	2451.30	36.65
Sex				
Female	3297	50.65	3159.58	47.23
Male •	3213	49.35	3529.74	52.77
Race				
White •	4592	70.54	5291.24	79.10
Black	1325	20.35	1001.32	14.97
Native American	233	3.58	205.64	3.07
Asian	360	5.53	191.11	2.86
Age				
12	6	0.09	10.74	0.16
13	494	7.59	641.73	9.59
14	893	13.72	1159.98	17.34
15	1234	18.96	1430.19	21.38
16	1471	22.60	1358.00	20.30
17	1537	23.61	1328.85	19.87
18	686	10.54	580.52	8.68

19	170	2.61	160.15	2.39
20	17	0.26	16.62	0.25
21	2	0.03	2.52	0.04
Maturity				
Younger than most	534	8.20	536.31	8.02
Younger than some	677	10.40	686.63	10.26
About average	2490	38.25	2497.14	37.33
Older than some	1878	28.85	1954.72	29.22
Older than most	931	14.30	1014.50	15.17
Household Education				
Eighth	193	2.97	179.35	2.68
No high school	465	7.14	493.27	7.37
Trade	39	0.60	48.38	0.72
High school	1689	25.94	1887.75	28.22
GED	283	4.35	305.29	4.56
Tradetwo	478	7.34	526.48	7.87
No College	951	14.61	957.18	14.31
College/Uni Graduate •	1595	24.50	1557.59	23.28
Grad	817	12.55	734.01	10.97
Religious Involvement				
Churchweek	2474	38.00	2467.23	36.88
Churchmonth	1275	19.59	1299.41	19.43
Churchrandom	1196	18.37	1191.65	17.81
Never •	1565	24.04	1731.02	25.88

n=6,510
• = referent group

Table 8

Weighted Sample Means

Variable	Mean	SD
Age of First Sexual Intercourse - Waves I, II, & III	16.328	2.197
Depression - Wave I	4.933	3.889
Depression - Wave II	4.821	3.859
Depression - Wave III	3.791	3.694
Age	15.601	1.586
Pubertal Maturity	3.333	1.116
Age of Menarche	-0.026	0.889
Self-Esteem	11.220	3.587
Social Support	20.504	2.761
Household Education	6.877	2.300
Household Income	45.798	47.301

Note. Data is from Wave I of the Add Health, unless otherwise indicated.
n=6,510

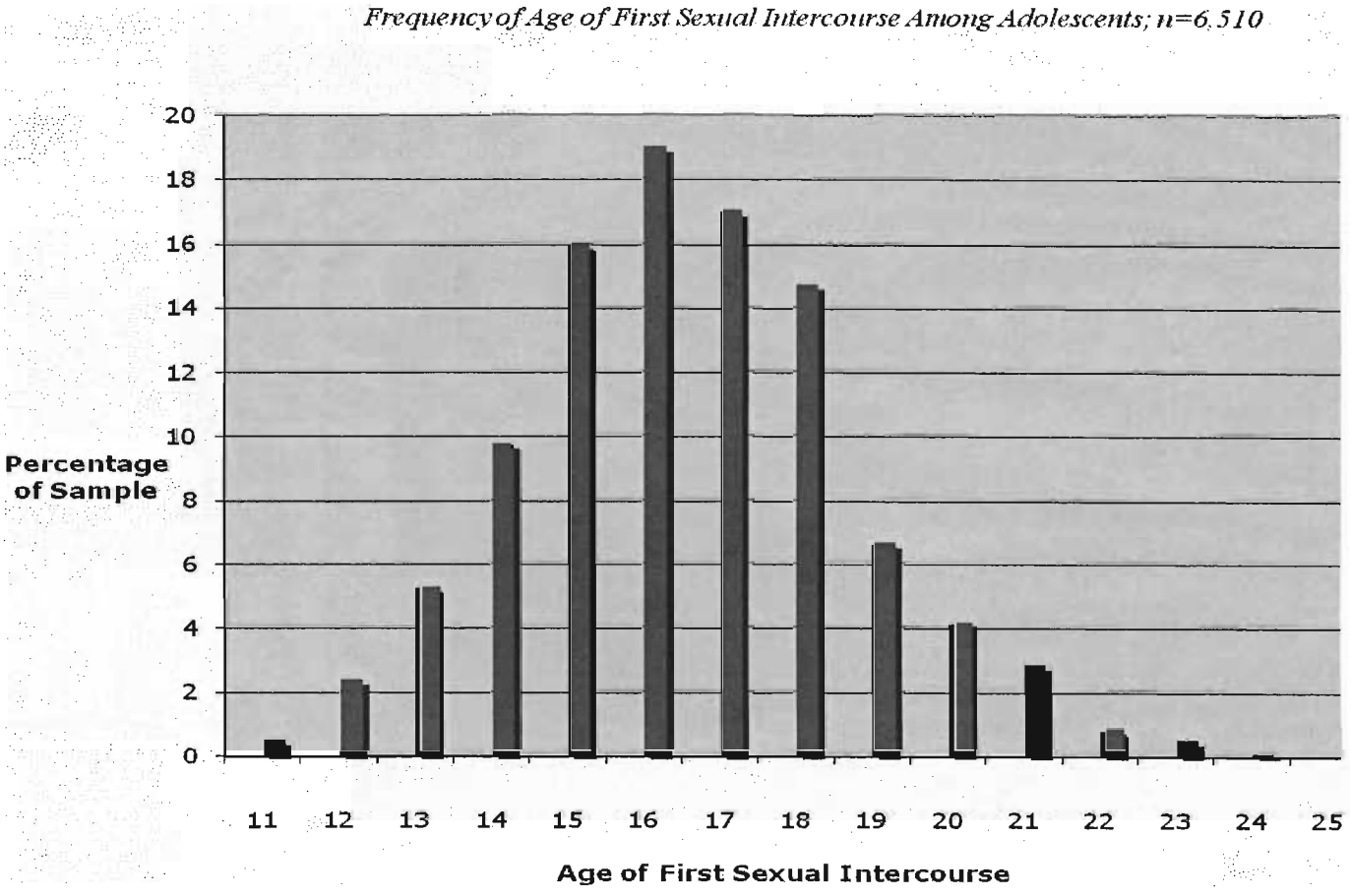
age, and the lowest frequency being 21 years of age (n=2; 0.03%). Thirty-nine percent of youth from Wave I in the final sample (n=2,545) were sexually active. The mean age of first sexual intercourse in the final sample was 16.328 years of age (SD=2.197) (see Table 8). The highest frequency of age of first sexual intercourse occurred at age 16 (n=1,236; 18.99%), and was followed by age 17 (n=1,110; 17.05%), and age 15 (n=1,041; 15.99%) (see Figure 3). The lowest frequency of age of first intercourse occurred at age 25 (n=5; 0.08%). Figure 4 provides characteristics of the full longitudinal sample (n=6,510) on age of first coitus.

Those respondents whose parents had either graduated from high school (n=1,689; 25.94%) or from College or University (n=1,595; 24.50%) had the highest representation in the final sample. The lowest frequency of household education was represented by those who went to a business, trade, or vocational school instead of high school (n=39; 0.60%). The average household had a completed Graduate Education Diploma, while the mean household income was $45,798 per annum (see Table 8). Finally, those respondents who attended religious services at least once a week represented 38.00% of the final sample (n=2,474), followed by those who never attended religious services (n=1,565; 24.04%). Respondents who went to religious services less than once a month had the lowest frequency (n=1,275) and represented 19.59% of the final sample.

Sample Attrition Analyses

To examine any bias based on deletion of cases due to missing data, a dichotomous variable was created to compare respondents retained in the analysis

Figure 3


Frequency of Age of First Sexual Intercourse Among Adolescents; n=6,510
Percentage of Sample
20
18
16
14
12
10
8
6
4
2
0
11
12
13
14
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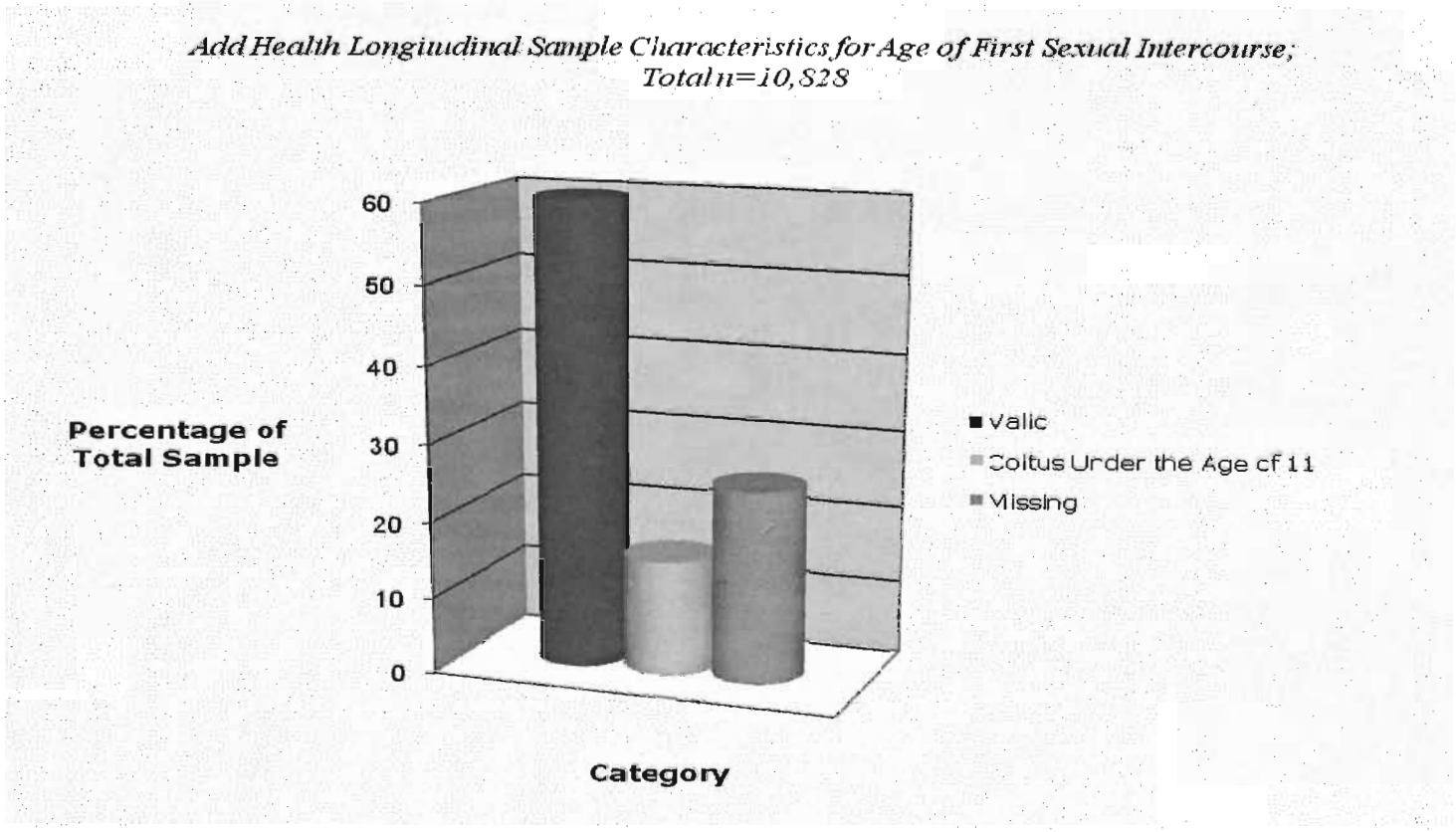
23
24
25
Age of First Sexual Intercourse

Figure 4


Add Health Longitudinal Sample Characteristics for Age of First Sexual Intercourse;
Total n=10,828
Percentage of Total Sample
60
50
40
30
20
10
0
Valic
Coitus Under the Age of 11
Missing
Category

(n=6,510) to those cases that were deleted due to any missing data (n=13,961). Respondents with no missing data were coded as 0 and respondents with one or more missing values were coded as 1. This new variable permitted analyses to identify patterns or differences between groups. Using this constructed variable, comparisons were made between groups across all variables to identify potential sources of sample bias. T-tests were performed to compare the two groups on continuous variables and chi-square analyses were used to compare the two groups across categorical variables. Table 9 provides the results between respondents with complete data and missing data on the categorical variables, while Table 10 compares respondents with complete data and missing data on the continuous biopsychosocial variables in this thesis.

There was a statistically significant difference between those with and without missing data based on race (χ^2=183.92, p<.001) and religious involvement (χ^2=12.70, p<.01). Those respondents with missing data had a higher mean average of depression at Wave II (t=-2.39, p<.05) and at Wave III (t=-4.09, p<.001), were younger (t=5.60, p<.001), were less physically mature (t=9.53, p<.001), and had higher levels of social support (t=-4.55, p<.001) than those without missing data. A final sample that is characterized by lower levels of depressive symptomatology suggests that the results of this thesis are likely to be conservative due to the restricted range of scores.

Table 9

Comparison Between Participants with Complete Data and Participants with Missing Data on Wave I Categorical Biopsychosocial Variables

Variable	No Missing Data		Missing Data		χ^2
	n	%	*n*	%	
Female	3297	50.65	7046	50.47	0.055
Male •	3213	49.35	6915	49.53	0.055
White •	4181	64.22	7734	55.40	183.920***
Black	1325	20.35	3214	23.02	183.920***
Native	233	3.58	477	3.42	183.920***
Asian	360	5.53	1199	8.59	183.920***
Church Never •	1565	24.04	3661	26.22	12.700**
Church Week	2474	38.00	5237	37.51	12.700**
Church Month	1275	19.59	2663	19.07	12.700**
Church Random	1196	18.37	2400	17.19	12.700**

*p<.05; **p<.01; ***p<.001 (two-tailed)
• = referent group
Final sample, n=6,510

Table 10

Comparison Between Participants with Complete Data and Those with Missing Data on Continuous Variables

Variable	No Missing Data	Missing Data	*t*
	Mean (SD)	Mean (SD)	
Age of First Intercourse - Waves I, II & III	16.328 ± 2.200	16.335 ± 2.124	-0.15
Depression - Wave I	4.933 ± 3.889	5.051 ± 3.820	-1.52
Depression - Wave II	4.822 ± 3.859	5.006 ± 3.822	-2.39*
Depression - Wave III	3.791 ± 3.694	4.100 ± 3.786	-4.09***
Age	15.601 ± 1.586	15.418 ± 1.692	5.60***
Maturity	3.333 ± 1.116	3.117 ± 1.103	9.53***
Age of Menarche	-0.026 ± 0.889	-0.018 ± 0.828	-0.42
Self-Esteem	24.780 ± 3.587	24.659 ± 3.535	1.68
Social Support	20.504 ± 2.761	20.762 ± 2.875	-4.55***
Household Education	6.877 ± 2.300	6.829 ± 2.387	0.97
Household Income	45.798 ± 47.301	45.767 ± 46.146	0.03

Note. Data is from Wave I, unless otherwise indicated.
*$p<.05$; **$p<.01$; ***$p<.001$(two-tailed)
Final sample, n=6,510

Biopsychosocial Analyses

After listwise deletion of all respondents with missing values, bivariate and multivariate analyses were conducted on the final sample. Bivariate analyses were used to search for patterns or differences across specific variables on both age of sexual onset and depressive symptomatology. A correlation analysis was used to examine the associations between depressive symptomatology, age of first intercourse and all biological, psychological, and sociological variables (see Tables 11.1 and 11.2).

Multivariate Descriptive Analyses

Multivariate analyses were employed to examine the independent effects of variables after removing the effect of other variables. The four research questions were answered through the use of multiple regression analyses.

Research Question #1

Using data from Wave I, a multiple regression analysis examining age of first sexual intercourse (determined using data from any of Wave I, II, or III) was regressed separately on the biological, psychological, and sociological groups of variables, and then simultaneously on all of the biopsychosocial variables combined. This allowed for the examination of the independent contribution of each domain on age of first coitus as well as the adjusted effect of each domain, after controlling for the other two domains.

Sub-analyses. Two additional sub-analyses were also conducted using age of first sexual intercourse and depressive symptomatology. The first sub-analysis examined only those respondents who reported not yet having their first sexual intercourse prior to Wave I (but would have, or did have, sexual intercourse after Wave I). This was done to

Table 11.1

Weighted Correlations of the Predictor and Biopsychosocial Variables

	Age of 1st Coitus	Wave I Depression	Wave II Depression	Wave III Depression
Age of First Coitus	1	-0.860***	-0.101***	-0.075***
Depression - Wave I	-0.0860***	1		
Depression - Wave II	-0.101***	0.554***	1	
Depression - Wave III	-0.075***	0.308***	0.338***	1
Age	0.132***	0.133***	0.089***	-0.026*
Female	-0.016	0.156***	0.149***	0.066***
Black	0.131***	0.033**	0.010	0.055***
Native	0.097***	0.020	0.024*	0.018
Asian	0.122***	0.073***	0.069***	0.055***
Pubertal Maturity	-0.125***	0.000	-0.002	-0.035**
Age of Menarche	0.141***	-0.028*	-0.051***	-0.045***
Self-Esteem	0.054***	-0.501***	-0.368***	-0.209***
Household Education	0.139***	-0.154***	-0.147***	-0.079***
Household Income	0.109***	-0.084***	-0.087***	-0.054***
Social Support	0.130***	-0.308***	-0.233***	-0.132***
Church week	0.123***	-0.051***	-0.053***	-0.031*
Church month	-0.027*	0.004	-0.010	-0.005
Church random	-0.023	0.015	0.018	0.004

Note. With the exception of age of first coitus (Waves I, II, & III), data is from Wave I unless otherwise indicated.

Reference groups are Male, White, College/University Graduate, and Never going to religious ceremonies.

*p<.05; **p<.01; ***p<0.001
n=6,510

Table 11.2

Weighted Correlations of the Biopsychosocial Variables at Wave I

	Age	Female	Black	Native	Asian	Pubertal Maturity	Age of Menarche	Self-Esteem	Household Education	Household Income	Social Support	Church Week	Church Month
Age	1												
Female	-0.029*	1											
Black	-0.019	0.023	1										
Native	-0.010	0.013	-0.097***	1									
Asian	0.046***	0.009	-0.122***	-0.047***	1								
Pubertal Maturity	-0.019	0.062***	-0.050***	0.024*	-0.069***	1							
Age of Menarche	0.151***	-0.265***	-0.047***	-0.008	0.017	-0.169***	1						
Self-Esteem	-0.094***	-0.166***	0.126***	-0.009	-0.078***	-0.019	0.029*	1					
Household Education	-0.047***	-0.034**	0.008	-0.038**	0.111***	0.042***	0.051***	0.055***	1				
Household Income	0.022	-0.012	-0.180***	-0.042***	0.052***	0.022	0.051***	0.026*	0.320***	1			
Social Support	-0.091***	0.054***	0.032**	-0.028*	-0.002	-0.026*	0.010	0.430***	0.070***	0.039**	1		
Church week	-0.073***	0.026*	0.120***	-0.015	0.018	-0.024*	-0.022	0.068***	0.095***	0.012	0.102***	1	
Church month	0.003	0.013	0.038**	-0.028*	0.003	-0.012	0.006	0.021	0.009	0.001	0.015	-0.386***	1

Church random	0.062***	0.003	-0.080***	-0.010	-0.011	0.029*	0.008	-0.039**	-0.027*	0.038**	-0.029*	-0.371***	-0.234***

Reference groups are Male, White, College/University Graduate, and Never going to religious ceremonies.
*p<.05; **p<.01; ***p<0.001
n=6,510

address the potential that, among some respondents, the psychological, and sociological variables were assessed after one's first sexual occurrence and may be influenced by this experience.

The second sub-analysis, using this same subsample of respondents who reported not yet having had coitus, were examined with Wave I depressive symptomatology as a predictor in addition to the biopsychosocial variables. In this sub-analysis, age of first coitus was regressed on depressive symptoms first, and then biological, psychological, and sociological variables were inserted. This was done to see if higher levels of prior depressive symptomatology predicted an earlier onset of coitus and whether this relationship persisted once adjusted for the biopsychosocial factors. Thus, this thesis predicts age of first intercourse for those without sexual experience who would have, or did have, sexual experience after Wave I.

Research Question #2

To assess how biopsychosocial domains predict later depression, Wave III depressive symptomatology was regressed on each domain separately and then simultaneously using the same patterning as described above to address research question 1. In addition, a set of supplementary regression models following the same structure were computed that also included depressive symptomatology at Wave I as a predictor to examine whether the biopsychosocial factors account for changes in depression after adjusting for an initial baseline level of depressive symptomatology. This statistical technique partials out the baseline level of depressive symptomatology in order to explain any changes over time in this variable (see Kessler & Greenberg, 1981).

Research Question #3

To assess whether depressive symptomatology was predicted by early sexual onset, Wave III depression was regressed on age of first sexual intercourse. In addition, a supplementary analysis examined whether age of first coitus predicted change in depressive symptomatology at Wave III after adjusting for baseline depressive symptomatology at Wave I.

Research Question #4

Finally, depressive symptomatology at Wave III was regressed on age of first sexual intercourse, adjusting for the biological, psychological, and sociological determinants. This model assessed whether any effect of timing of sexual onset on later depressive symptomatology remained after the inclusion of the biopsychosocial predictors. This analysis was also replicated following the sub-analysis in research question 3, adjusting for baseline depressive symptomatology to examine whether age of first sexual intercourse predicted change in depressive symptomatology after adjusting for biopsychosocial covariates.

CHAPTER 5: RESULTS

Bivariate Analyses

Depressive symptomatology was positively correlated ($p<.001$) at all three Waves with being female and being Asian (see Table 11.1). Thus, females and Asian adolescents had higher levels of depressive symptomatology in this study. In contrast, depressive symptomatology was negatively correlated at all three Waves of data analysis with age of menarche, self-esteem, household education, household income, social support, and weekly religious involvement. Thus, those respondents with higher levels of psychological distress at all Waves of data analysis were characterized by menarche at an earlier age, lower self-esteem, household education, household income, social support, and weekly attendance at religious ceremonies. Furthermore, depressive symptomatology at each Wave was negatively correlated ($p<.001$) with age of first sexual intercourse (see Table 11.1).

A significant difference was not observed between males and females on age of first sexual intercourse (see Table 12). Thus, male and female youth did not differ on the age at which they reported their first vaginal/penile intercourse.

Multivariate Analyses

Research question #1

Age of first sexual intercourse was regressed separately on biological, psychological, and sociological groups of variables, and then simultaneously on the biopsychosocial variables combined. Biology (as assessed by age, sex, race, pubertal maturity, and age of menarche) accounted for 6.19% of the variance in age of first sexual

Table 12

Sex Differences Across Waves on Depressive Symptomatology and Age of First Sexual Intercourse

Variable	Female	Male	
	Mean (SD) *n*=3,297	Mean (SD) *n*=3,213	*t*
Depression Wave I	5.685 ± 4.119	4.259 ± 3.492	-15.23***
Depression Wave II	5.508 ± 4.029	4.207 ± 3.556	-13.98***
Depression Wave III	4.143 ± 3.837	3.476 ± 3.508	-7.41***
Age of 1st Coitus - Waves I, II, & III	16.296 ± 2.081	16.356 ± 2.309	1.12

Note. *$p<.05$; **$p<.01$; ***$p<.001$; (two-tailed)
n=6,510

intercourse (F=27.05, p<.001, df=7, 128) (see Table 13.1, Model 1). Of these variables, respondent' age (t=6.33, p<.001), being Black (t =-6.76, p<.001), Asian (t =2.14, p<.05), pubertal maturity (t =-6.40, p<.001) and, for females, menarche (t =7.06, p<.001) were all significant predictors of early age of first intercourse. Thus, age, and age of first sexual intercourse were an effect of time, in that, respondents reported being 0.166 years older at time of first sexual intercourse. Table 13.1, Model 1, also shows that on average, Blacks commenced first sexual intercourse 0.789 years earlier than Whites. In contrast, Asians participated in first coitus 0.465 years later than Whites. In addition for every one unit increase in pubertal maturity, respondents reported having first sexual intercourse 0.226 years earlier. Finally, as an objective measure of pubertal maturity among females (age of menarche), results revealed that, on average, for every one year increase in age of first menarche, females reported being 0.241 years older at time of first sexual experience. In Table 13.1, Model 2, the psychological variables (comprised of self-esteem and social support) accounted for 1.68% of the variance in age of first coitus (F=26.53, p<.001, df=2,128). However, only social support (t=6.24, p<.001) was a significant predictor of age of first sexual intercourse. Specifically, for every one unit increase in levels of social support, respondents reported being 0.104 years older at time of first coitus. Sociological variables (as assessed by household education, household income, and religious involvement) accounted for 4.37% of the total variance in age of first coitus (F=25.60, p<.001, df=5, 128). In Table 13.1, Model 3, household education (t=4.86, p<.001), household income (t=5.03, p<.001), weekly (t=7.04, p<.001), and monthly religious attendance (t=2.18, p<.05) were significant. Thus, for every unit increase in household

Table 13.1

Wave I Biopsychosocial Predictors of Age of First Sexual Intercourse

Variables	*Model 1* Biological			*Model 2* Psychological			*Model 3* Sociological			*Model 4* Biopsychosocial		
	β	SE	*t*	β	SE	*t*	β	SE	*t*	β	SE	*t*
	R^2=0.0619			R^2=0.0168			R^2=0.0437			R^2=0.119		
Age	0.166	0.026	6.33***							0.203	0.025	8.00***
Female	-0.010	0.077	-0.14							-0.052	0.074	-0.70
Black	-0.789	0.117	-6.76***							-0.809	0.114	-7.10***
Native	-0.175	0.184	-0.95							-0.006	0.169	-0.03
Asian	0.465	0.217	2.14*							0.347	0.195	1.78
Maturity	-0.226	0.035	-6.40***							-0.222	0.035	-6.40***
Age of Menarche	0.241	0.034	7.06***							0.216	0.034	6.29***
Self-Esteem				-0.001	0.011	-0.13				0.005	0.012	0.45
Social Support				0.104	0.017	6.24***				0.088	0.016	5.60***

Household Education			0.096	0.020	4.86***	0.088	0.017	5.19***
Household Income			0.004	0.001	5.03***	0.002	0.001	4.19***
Churchweek			0.709	0.101	7.04***	0.736	0.096	7.63***
Churchmonth			0.193	0.089	2.18*	0.199	0.085	2.33*
Churchrandom			0.112	0.109	1.04	0.076	0.110	0.69

Note. Reference groups are Male, White, College/University Graduate and Never going to religious ceremonies.
Age of first sexual intercourse was assessed across all three Waves of data collection.
*p<.05; **p<.01; ***p<.001; (two-tailed)
n=6,510; df=128

education (recall that this thesis assessed education from "eighth grade or less" to "professional training beyond a 4-year college or University degree"), adolescents reported being 0.096 years older at the time of first genital union. For every one unit increase in household income, adolescents reported being 0.04 years older at first sexual intercourse. Those respondents who attended religious ceremonies at least once a week, participated in first sexual intercourse 0.709 years later than those who never went to religious ceremonies. Respondents who attended religious ceremonies monthly also had an older age of first genital union. They had their first sexual intercourse, on average, 0.193 years later than those adolescents who did not have religious involvement. Furthermore, adolescents who attended religious ceremonies less than once a month were not significantly different from those with no reported religious involvement, with respect to a difference in age of first coitus.

When all biopsychosocial variables were included in the model (see Table 13.1, Model 4), they accounted for 11.94% (F=24.85, p<.001, df=14, 128) of the variance in age of first coitus. The significant biological variables in this model were age (t=8.00, p<.001), Black (t=-7.10, p<.001), pubertal maturity (t=-6.40, p<.001) and menarche (t=6.29, p<.001). Social support (t=5.60, p<.001) was the only significant psychological predictor, while household education (t=5.19, p<.001), household income (t=4.19, p<.001) and religious involvement remained significant sociological predictors of age of first sexual intercourse. In this final model, the association between being Asian and age of first sexual intercourse became non-significant with the addition of psychological and sociological variables. In general, the biological variables that were analyzed in this

thesis were the strongest predictors of age of first coitus. However, the inclusion of psychological and sociological variables accounted for an additional 5.75% of the variance in age of first sexual intercourse apart from the biological variables alone.

Sub-analyses. The following two sub-analyses assessed the predictors of age of first coitus in adolescents with no previous sexual debut in Wave I. In the first sub-analysis (Table 13.2, Model 1), the biopsychosocial variables predicted 22.63% (F=37.94, p<.001, df=14, 128) of the variance in age of first sexual intercourse among adolescents with no previous sexual debut (n=3,965). The significant predictors in of age of first coitus among this subsample were age, being Black, pubertal maturity, age of menarche, social support, household education, and weekly religious involvement. Thus, on average, among this group of adolescents, for every one-year increase in age, teens with no prior sexual debut reported being 0.577 years older at time of first sexual experience. On average, Blacks commenced first coitus 0.445 years earlier than Whites. For every one-unit increase in physical maturity, adolescents reported being 0.117 years younger at time of first genital union. For every one-year increase in age of first menarche, females reported being 0.106 years older at first coitus. For every one-unit increase in social support, these adolescents were 0.060 years older when they first engaged in coitus. For every one-unit increase in household education, respondents reported being 0.086 years older when they first began participating in sexual intercourse. Finally, youth with no prior sexual debut who attended religious ceremonies weekly had sexual intercourse 0.454 years later than those who did not have any religious involvement. The relationship between Wave I depressive symptomatology and age of

Table 13.2

Predictors of Age of First Sexual Intercourse in Adolescents With No Previous Sexual Debut

Variables	*Model 1*			*Model 2*			*Model 3*		
	β	SE	*t*	β	SE	*t*	β	SE	*t*
		R^2=0.226			R^2=0.001			R^2=0.227	
Depression - Wave I				-0.013	0.012	-1.11	-0.013	0.012	-1.08
Age	0.577	0.030	18.93***				0.579	0.031	18.82***
Female	-0.025	0.077	-0.33				-0.015	0.079	-0.19
Black	-0.445	0.134	-3.31***				-0.436	0.135	-3.22**
Native	-0.108	0.168	-0.64				-0.114	0.168	-0.68
Asian	0.301	0.188	1.65				0.319	0.190	1.68
Maturity	-0.117	0.039	-3.01**				-0.117	0.039	-3.02**
Age of Menarche	0.106	0.040	2.65**				0.150	0.040	2.62**
Self-Esteem	0.008	0.013	0.63				0.002	0.014	0.17
Social Support	0.060	0.017	3.53***				0.058	0.017	3.35***

Household Education	0.086	0.018	4.71***		0.084	0.018	4.60***
Household Income	0.001	0.001	1.41		0.001	0.001	1.37
Churchweek	0.454	0.105	4.33***		0.453	0.105	4.30***
Churchmonth	0.100	0.106	0.95		0.100	0.106	0.95
Churchrandom	0.043	0.123	0.35		0.039	0.123	0.32

Note. Reference groups are Male, White, College/University Graduate and Never going to religious ceremonies.
Age of first sexual intercourse was assessed across all three Waves of data collection.
*p<.05; **p<.01; ***p<.001
(two-tailed)
n=3,965; df=128

first sexual intercourse among adolescents with no previous sexual debut was also examined in this thesis (see Table 13.2, Model 2). Results indicated that Wave I depressive symptomatology did not predict subsequent age of first sexual intercourse among those who had not reported previous intercourse. When age of first sexual intercourse was regressed on depressive symptomatology and all of the biopsychosocial variables, Wave I depressive symptomatology remained a non-significant (t=-1.08, p=0.281) predictor of age of first coitus (see Table 13.2, Model 3). This model (Model 3) accounted for 22.66% of the variance in age of first sexual intercourse in this sub-sample of teens. The significant predictors (with Wave I depressive symptomatology added to the regression analyses) were the same as the previous analysis and included age, Black, pubertal maturity, menarche, social support, household education and weekly religious involvement. Thus, for every one-year increase in age, adolescents reported being 0.579 years older at time of first sexual experience. Black youth without prior sexual debut, on average, initiated first coitus 0.436 years earlier than Whites. For every one-unit increase in pubertal maturity, this sub-sample of youth reported being 0.117 years younger at first coitus. For every one-year increase in age of menarche, females reported being 0.150 years older at time of first genital union. For every one-unit increase in social support and household education, adolescents in this sub-sample reported being 0.058 and 0.084 years older at their first coitus, respectively. Finally, youth who were involved in weekly (or more than once a week) religious ceremonies had sexual intercourse 0.453 years later than those adolescents who did not have religious involvement. Thus, when regressed separately or when regressed with the biopsychosocial variables, Wave I depressive

symptomatology did not predict an earlier age of first sexual intercourse among adolescents with no previous sexual debut. Therefore, in this thesis, a higher level of Wave I depressive symptomatology did not predict an earlier age of first coitus among this sub-sample of adolescents. This same result was found in sexually active adolescents (see Table 13.3).

Research question #2

To address the second research question, Wave III depressive symptomatology was regressed separately and simultaneously on the biological, psychological, and sociological variables to analyze if these variables predicted higher levels of depressive symptomatology (see Table 14, Model 1). Biology (as measured by age, sex, race, pubertal maturity, and menarche) accounted for 1.89% of the variance in Wave III depression (F=11.31, p<.001, df=7, 128). Female adolescents scored, on average, 0.691 points higher on depressive symptomatology when compared with their male counterparts. Blacks scored, on average, 0.751 points higher than Whites on depressive symptomatology. Those who were more physically mature (pubertal maturity) scored, on average, 0.147 points lower on Wave III depressive symptomatology. Finally, for every one-year increase in age of menarche, females reported a 0.177 point decrease in Wave III depressive symptomatology. Psychological variables (as measured by self-esteem and social support) accounted for 4.60% of the variance in depressive symptomatology at Wave III (F=88.05, p<.001, df=2, 128). Both self-esteem (t=-10.46, p<.001) and social support (t=-2.43, p<.05) were significant negative predictors of later depressive symptomatology (see Table 14, Model 2). Thus, for every one-unit decrease in self-

Table 13.3

Predictors of Age of First Sexual Intercourse in Sexually Active Adolescents

Variables	*Model 1*			*Model 2*			*Model 3*		
	β	SE	*t*	β	SE	*t*	β	SE	*t*
		R^2=0.095			R^2=0.000			R^2=0.095	
Depression - Wave I				-0.002	0.010	-0.16	0.007	0.012	0.60
Age	0.272	0.044	6.19***				0.272	0.044	6.17***
Female	-0.191	0.088	-2.16*				-0.200	0.092	-2.15*
Black	-0.080	0.130	-0.62				-0.089	0.134	-0.67
Native	0.280	0.239	1.17				0.274	0.240	1.15
Asian	-0.010	0.247	-0.04				-0.017	0.246	-0.07
Maturity	-0.138	0.048	-3.51***				-0.167	0.048	-3.49***
Age of Menarche	0.189	0.043	4.42***				0.189	0.043	4.41***
Self-Esteem	-0.005	0.015	-0.35				-0.002	0.016	-0.11
Social Support	0.028	0.019	1.47				0.029	0.019	1.52

Household Education	0.003	0.020	0.15		0.004	0.020	0.20
Household Income	0.002	0.001	1.53		0.002	0.001	1.55
Churchweek	0.274	0.126	2.18*		0.273	0.126	2.18*
Churchmonth	0.189	0.139	1.36		0.190	0.139	1.37
Churchrandom	0.007	0.129	0.05		0.006	0.129	0.04

Note. Reference groups are Male, White, College/University Graduate and Never going to religious ceremonies.
Age of first sexual intercourse was assessed across all three Waves of data collection.
*p<.05; **p<.01; ***p<.001
(two-tailed)
n=2,545; df=123

Table 14

Wave I Biopsychosocial Predictors of Wave III Depressive Symptomatology

Variables	*Model 1* Biological			*Model 2* Psychological			*Model 3* Sociological			*Model 4* Biopsychosocial		
	β	SE	*t*	β	SE	*t*	β	SE	*t*	β	SE	*t*
	R^2=0.019			R^2=0.046			R^2=0.008			R^2=0.067		
Age	-0.054	0.036	-1.48							-0.117	0.036	-3.22**
Female	0.691	0.112	6.17***							0.454	0.122	3.71***
Black	0.751	0.182	4.13***							0.886	0.174	5.09***
Native	0.516	0.344	1.50							0.315	0.357	0.88
Asian	0.319	0.245	1.30							0.292	0.252	1.16
Maturity	-0.147	0.049	-3.00**							-0.139	0.051	-2.71**
Age of Menarche	-0.177	0.083	-2.14*							-0.125	0.079	-1.58
Self-Esteem				-0.193	0.018	-10.46***				-0.184	0.020	-9.36***
Social Support				-0.069	0.029	-2.43*				-0.077	0.029	-2.63**

Household Education			-0.106	0.030	-3.55***	-0.075	0.028	-2.68**
Household Income			-0.002	0.001	-2.24*	-0.001	0.001	-1.32
Churchweek			-0.271	0.167	-1.63	-0.253	0.166	-1.53
Churchmonth			-0.144	0.160	-0.90	-0.123	0.159	-0.78
Churchrandom			-0.217	0.183	-1.19	-0.189	0.177	-1.07

Note. Reference groups are Male, White, College/University Graduate and Never going to religious ceremonies.
*p<.05; **p<.01; ***p<.001
(two-tailed)
n=6,510; df=128

esteem and social support, respondents scored 0.193 and 0.069 points higher, respectively, on depressive symptomatology in Wave III. Finally, sociological variables accounted for 0.80% of the variance in Wave III depression (F=7.08, p<.001, df=5, 128), with household education (t=-3.55, p<.001) and household income (t=-2.24, p<.05) being the only statistically significant predictors (see Table 14, Model 3). Thus, for every one-unit decrease in household education, adolescents scored 0.106 points higher on depressive symptomatology in Wave III when compared with those adolescents who had a higher household education. Furthermore, for every one-unit decrease in household income, respondents scored 0.002 points higher on Wave III depressive symptomatology. When the biopsychosocial variables were regressed simultaneously on Wave III depression (Table 14, Model 4), they accounted for 6.74% of the variance in future depressive symptomatology (F=22.22, p<.001, df=14, 128). In this model (Table 14, Model 4), age (t=-3.22, p<.01), sex (t=3.71, p<.001), being Black (t=5.09, p<.0001), pubertal maturity (t=-2.71, p<.01), self-esteem (t=-9.36, p<.001), social support (t=-2.63, p<.01), and household education (t=-2.68, p<.01) were significant. The changes in the final model that were identified by the simultaneous addition of the biopsychosocial variables were as follows: age became statistically significant while menarche and household income were no longer significant. Thus, for every one-year decrease in age youth scored 0.117 points higher on depressive symptomatology at Wave III when psychological and sociological variables were added to the regression analysis.

Research question #3

This research question addressed whether an earlier age of first sexual intercourse

was predictive of higher levels or an increase in depressive symptomatology at Wave III. When Wave III depressive symptomatology was regressed separately on age of first coitus, it accounted for 0.564% (t=-4.20, p<.001) of the variance in the final model (F=17.67, p<.001, df=1,128) (see Table 15, Model 1). Thus, for every one-unit increase in Wave III depressive symptomatology, adolescents reported being 0.126 years younger at time of first coitus; depressive symptomatology was predicted by earlier sexual onset. When regressed simultaneously to assess change in depressive symptomatology, age of first sexual intercourse (t=-2.98, p<.01) and baseline depressive symptomatology at Wave I (t=19.10, p<.001) were both significant and accounted for 9.71% of the variance in Wave III depressive symptomatology (F=184.74, p<.001, df=2, 128) (see Table 15, Model 2). Therefore, for every one-year increase in age of first sexual intercourse, adolescents reported an increase of 0.082 units in depressive symptomatology. In addition, for every one-unit increase in Wave I depression youth scored 0.288 points higher on Wave III depression indicating a high level of stability in depressive symptomatology over seven years. Thus, an earlier age of first coitus significantly predicts an increase in subsequent depressive symptomatology after adjusting for baseline depressive symptomatology.

Research question #4

When Wave III depressive symptomatology was regressed simultaneously on the biopsychosocial variables and age of first coitus, however, the predictive effect of age of first sexual intercourse on depressive symptomatology was no longer significant (see Table 15, Model 3). Age (t=-2.83, p<.01), sex (t=3.72, p<.001), Black (t=4.88, p<.001),

pubertal maturity (t=-2.97, p<.01), self-esteem (t=-9.34, p<.001), social support (t=-2.48, p<.01), and household education (t=-2.50, p<.01) were significant predictors of depressive symptomatology at Wave III, accounting for 6.84% of the variance in depressive symptomatology (F=21.29, p<.001, df=15, 128). Thus, the effect of age of first coitus on Wave III depressive symptomatology disappeared in the presence of the biopsychosocial predictors.

Sub-analysis. The sub-analysis examining whether age of first sexual intercourse predicted change in depressive symptomatology after adjusting for biopsychosocial covariates was non-significant. When the biopsychosocial variables were added to the regression analysis, only Wave I depressive symptomatology remained a significant predictor of Wave III depressive symptomatology (t=14.58, p<.001) (see Table 15, Model 4). Age (t=-4.29, p<.001), sex (t=2.07, p<.05), Black (t=3.35, p<.001), pubertal maturity (t=-2.88, p<.01), and self-esteem (t=-3.53, p<.001) remained significant predictors of change in depressive symptomatology from Wave I to Wave III. Thus, the predictive effect of age of first coitus on both Wave III depressive symptomatology and changes over time in depressive symptomatology disappeared when biopsychosocial predictors were included in the final model. Therefore, it appears in this sample of adolescents that the effect of age of first sexual intercourse on depression is spurious, both being predicted by these other variables (see Figure 5).

Table 15

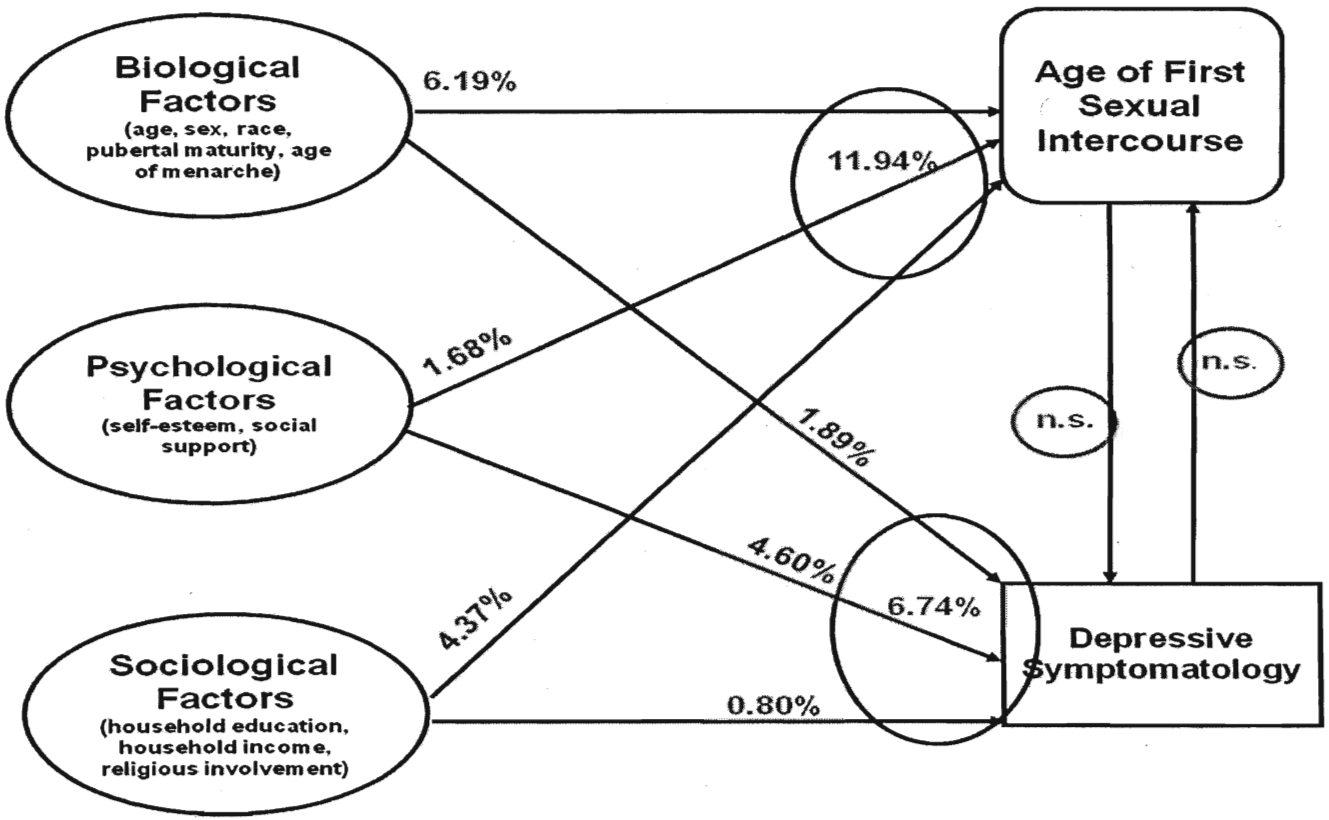
Predictors of Wave III Depressive Symptomatology

Variables	*Model 1*			*Model 2*			*Model 3*			*Model 4*		
	β	SE	*t*	β	SE	*t*	β	SE	*t*	β	SE	*t*
	R^2=0.006			R^2=0.097			R^2=0.068			R^2=0.113		
Age of 1st Coitus - Waves I, II, & III	-0.126	0.030	-4.20***	-0.082	0.028	-2.98**	-0.056	0.032	-1.76	-0.043	0.030	-1.44
Depression - Wave I				0.288	0.015	19.10***				0.242	0.017	14.58***
Age							-0.106	0.037	-2.83**	-0.153	0.036	-4.29***
Female							0.451	0.121	3.72***	0.258	0.125	2.07*
Black							0.840	0.172	4.88***	0.586	0.175	3.35***
Native							0.315	0.359	0.88	0.315	0.328	0.96
Asian							0.311	0.253	1.23	0.122	0.247	0.50
Maturity							-0.152	0.051	-2.97**	-0.143	0.050	-2.88**
Age of Menarche							-0.113	0.080	-1.41	-0.101	0.078	-1.30
Self-Esteem							-0.184	0.020	-9.34***	-0.073	0.021	-3.53***

Social Support			-0.072	0.029	-2.48**	-0.033	0.028	-1.18
Household Education			-0.070	0.028	-2.50**	-0.031	0.027	-1.14
Household Income			-0.001	0.001	-1.17	-0.001	0.001	-0.74
Churchweek			-0.212	0.171	-1.24	-0.192	0.160	-1.19
Churchmonth			-0.112	0.160	-0.70	-0.112	0.157	-0.71
Churchrandom			-0.184	0.177	-1.04	-0.164	0.171	-0.96

Note. Reference groups are Male, White, College/University Graduate, and Never going to religious ceremonies. Data is from Wave I, unless otherwise indicated.
*p<.05; **p<.01; ***p<.001; (two-tailed)
n=6,510; df=128

Figure 5


Biological Factors
(age, sex, race, pubertal maturity, age of menarche)
Psychological Factors
(self-esteem, social support)
Sociological Factors
(household education, household income, religious involvement)
Age of First Sexual Intercourse
Depressive Symptomatology
6.19%
1.68%
4.37%
11.94%
1.89%
4.60%
6.74%
0.80%
n.s.
n.s.

CHAPTER 6: DISCUSSION

The previous chapter presented the results of the analyses examining the relationship between age of first sexual intercourse, depressive symptomatology, and the biological (age, sex, race, maturity, age of menarche), psychological (self-esteem, social support), and sociological (household education, household income, religious involvement) variables. This chapter will discuss these findings in relation to previous research and the research objectives that guided this thesis. It will also provide conclusions and implications for the findings of this thesis.

Review of Objectives

The purpose of this study was to explore the equivocal findings of previous empirical research on adolescent depression and sexual intercourse by examining it longitudinally over a seven-year time interval, and grounding it within a biopsychosocial framework to assess its directionality. Past research has indicated a link between depression and coitus, in that, those adolescents who have earlier sexual intercourse may be more likely to experience subsequent depressive symptomatology. While four of the six articles reviewed suggested that earlier sexual intercourse may predict subsequent depression (Hallfors et al., 2004; Hallfors et al., 2005; Rector et al., 2003; Tubman et al., 1996), two of the articles suggest the opposite effect, that is, depression may be predictive of earlier onset sexual intercourse (Lehrer et al., 2006; Sabia, 2006). Thus, the temporal ordering of genital union and psychological distress has been questioned. However, these equivocal findings suggest that the relationship between the variables of

interest may be spurious; that is, there may be biological, psychological, or sociological variables that may predict *both* depression and sexual intercourse.

Furthermore, the results of all six previous studies are fraught with various limitations. These limitations include the use of cross-sectional data, longitudinal results that are separated by only one or two years, the lack of a definition of sexual intercourse, use of one-item from a multi-item scale to indicate depression, and insufficient information on what represents "early" sexual intercourse. This thesis addressed these limitations by utilizing a seven-year longitudinal dataset, clearly defining sexual intercourse as "male/female penile-vaginal intercourse", using 8-items of the CES-D to analyze depressive symptomatology, and addressing an earlier age of sexual intercourse. As a result of the inclusiveness of this thesis, the findings can be considered to be more precise than previous research.

In addition, this thesis examined the temporal ordering between depression and first sexual intercourse in adolescents within a biopsychosocial model (Engel, 1977). Previous research has neglected the use of a theoretical framework. The biopsychosocial model provides an excellent frame of reference to examine the relationship between depression and coitus, in that, biological (age, sex, race, pubertal maturity), psychological (self-esteem, social support), and sociological (socioeconomic status, religious involvement) variables have been associated with *both* depression and early participation in sexual intercourse.

Results Related to Research Questions

To assess the temporal ordering of depression and age of first sexual intercourse, four research questions were proposed. The first research question addressed whether biological, psychological, and sociological factors predicted age of first sexual intercourse. When regressed separately, biological variables accounted for 6.19% of the variance, psychological variables accounted for 1.68% of the variance, and sociological variables accounted for 4.37% of the variance in age of first coitus. When regressed simultaneously, the biopsychosocial variables explained 11.94% of the variance in age of first coitus. Thus, although the biological variables accounted for 6.19% of the variance in earlier age of first sexual intercourse in this study, the inclusion of psychological and sociological variables almost doubled the explained variance in age of first coitus compared to biology alone.

Two sub-analyses examined how depressive symptomatology predicted age of first sexual intercourse among adolescents with no previous sexual debut at Wave I. In the first sub-analysis, biopsychosocial variables predicted 22.63% of the variance in age of first sexual intercourse. However, the relationship between Wave I depressive symptomatology and age of first sexual intercourse in this sub-sample was found to be non-significant, indicating that higher levels of depressive symptomatology do not predict an earlier age of first sexual intercourse. In addition, Wave I depressive symptomatology did not predict an earlier age of first sexual intercourse among this adolescent sub-sample, whether it was regressed separately or with the biopsychosocial

variables. This indicates that this direction of the relationship is not likely; that is, depression does not likely predict sexual intercourse.

To address the second research question, depressive symptomatology (Wave III) was regressed separately and simultaneously on the biological, psychological, and sociological variables. When regressed separately, biological factors accounted for 1.89% of the variance, psychological factors accounted for 4.60% of the variance, and sociological variables accounted for 0.80% of the variance in Wave III depression. Wave III depressive symptomatology accounted for 6.74% of the variance in the biopsychosocial variables. Thus, although the biopsychosocial variables accounted for the most variance in depressive symptomatology, psychological variables were the single strongest predictors of depressive symptomatology.

Next, Wave III depression accounted for 0.564% of the variance in future depressive symptomatology. Results indicated that those adolescents who were younger at time of first coitus had higher depressive symptomatology. When depressive symptomatology at Wave I was included in the analysis, age of first coitus remained significant. As such, age of first sexual intercourse was predictive of both subsequent depressive symptoms as well as changes in levels of depressive symptoms.

However, after controlling for biological, psychological, and sociological factors, age of first coitus did not predict higher levels of subsequent depressive symptomatology nor did it predict a change in depressive symptomatology. Thus, it appears that the effect of age of first sexual intercourse on depression is spurious, as both are predicted by these biopsychosocial variables.

Integration with Previous Research

The results from this thesis can be integrated with past research on psychological distress and an early age of first intercourse. In this section, the previously discussed six studies are reviewed in consideration of the findings of the current study.

Study #1

Tubman et al. (1996) found that adolescents who engaged in earlier onset sexual intercourse reported higher levels of depressive symptomatology. This thesis goes beyond the scope of Tubman et al.'s (1996) research, in that, it includes the influence of biopsychosocial variables on this relationship. This thesis provides evidence that the relationship between age of first sexual intercourse and depressive symptomatology was *not* significant when biopsychosocial variables were controlled.

The differing results between Tubman et al.'s (1996) research and this thesis may be as a result of various limitations in Tubman et al.'s study. For example, this thesis was a seven-year longitudinal study with a clear operational definition of sexual intercourse and a nationally representative sample. Although Tubman et al.'s (1996) study had a robust depressive measure, it lacked a clear operational definition of sexual intercourse. Furthermore, from their definition of coitus ("how many times have you engaged in sexual activity involving actual intercourse"), it cannot be determined if Tubman et al. measured oral, anal, or vaginal intercourse. Earlier coitus in the form of oral or anal sex may have different implications for later depressive symptomatology when compared with vaginal intercourse. For example, anal sex may be more common among teens who engage in risky behaviours.

Although their study was longitudinal, it was only two years in length. Empirical research benefits from longitudinal analyses of greater duration that accommodate the multiple changes that are characteristic of adolescence. The added years that are accounted for in lengthy longitudinal studies will reduce right-handed censoring of the data. Right-hand censoring refers to the occurrence of an event after the last observation time in the study has been recorded. For example, in this thesis, I am able to account for the occurrence of first sexual intercourse in teens over a longer time period by analyzing adolescents over seven years. As a result, there is an increased confidence that right-hand censoring has not occurred in the data presented in this study.

Finally, the white, middle class, suburban sample that Tubman et al. utilized may differ dramatically from a nationally representative sample. Thus, Tubman et al.'s (1996) findings are not generalizable to other groups of adolescents, and are therefore not applicable to many adolescents. This thesis utilized a nationally representative sample of adolescents to ensure generalizability to an American population.

Study #2

Rector et al.'s (2003) study indicated that sexually active teens were significantly more likely to be depressed than teens who were not sexually active, after adjusting for race, gender, age, and family income. However, their study prompts multiple concerns. This thesis determined that, after adjusting for biopsychosocial factors, age of first sexual intercourse did not predict higher levels of subsequent depressive symptomatology, nor did it predict a change in depressive symptomatology. This thesis suggests that Rector et al.'s study was underspecified, failing to account for

other important predictors in the relationship between earlier sexual intercourse and psychological distress.

Study #3

The third empirical review of adolescent depression and early coitus was completed by Hallfors et al. in 2004, who reported that adolescents who were sexually active were 2.65 times more likely to be depressed than abstainers. This thesis reported that an earlier age of first sexual intercourse was *not* associated with subsequent depressive symptomatology after accounting for biological, psychological, and sociological factors. Therefore, the findings of this thesis do not support Hallfors et al.'s study. The current study improved on Hallfors et al.'s research by incorporating psychological factors, as well as additional biological and sociological factors, to more fully explain potential confounders in the relationship between sexual onset and depression. Furthermore, while their study provides a cross-sectional analysis of the association between sexual intercourse and depression, it was improved upon in this thesis through the use of longitudinal analyses utilizing data from more than one Wave of the Add Health. Employing all three Waves of the Add Health provided a thorough examination of the relationship of earlier coitus and subsequent depression as youth progressed from adolescence to adulthood.

Study #4

Multinomial and multivariate logistic regression analyses tested the temporal ordering of *high-risk* sexual intercourse and depression, while controlling for pubertal timing, race, age, gender, SES, and family structure in Hallfors et al.'s (2005) study. In

their 2005 study, Hallfors et al. reported that prior depression did not predict sexual behavior among youth. That is, depressed teens did not seek out sexual intercourse. However, those adolescents who reported being engaged in sexual intercourse in Wave I were more likely to state that they were depressed one year later in the subsequent wave. Hallfors et al.'s findings were not supported in this thesis when a longer interval between sexual intercourse and depression was examined. This thesis improves on Hallfors et al.'s (2005) study by examining earlier sexual activity, rather than *high-risk* sexual activity, which may have accounted for the difference in the findings between these two studies.

Study #5

The first study that provided contrary results to the previous empirical evidence was conducted by Lehrer et al. (2006). They tested whether sexual *risk* behaviors predicted depression in a longitudinal analysis of Waves I and II of the Add Health public-use dataset. Lehrer et al. found that teens with high depressive symptomatology were more likely than those with low depressive symptomatology to report sexual risk behavior one year later. This thesis was unable to find evidence to support the results of Lehrer et al.'s research looking at the relationship over a longer time interval. Instead, higher levels of depressive symptomatology did not significantly predict an earlier age of first sexual intercourse in this thesis. While Lehrer et al. identified a temporal ordering that was opposite of the previous research discussed, this relationship may have only existed as a result of their focus on sexual *risk* behaviors instead of more normative sexual activities.

Study #6

Finally, Sabia (2006) analyzed earlier teen coitus and depression among adolescents using Waves I and II of the Add Health. He reported that sexual intercourse predicted depression in females aged 13-16 after adjusting for gender, race, romantic relationship status, attempted suicides of family or friends, parental fighting, parent-child fighting, intelligence, academic performance, alcohol consumption, health, household demographics, mothers' depression, religiosity, and location. Using a longer interval between coitus and depression, the results of the current study found that an earlier age of first sexual intercourse explained 0.56% of the variance in depressive symptomatology. However, after adjusting for biopsychosocial factors, this relationship was non-significant.

This thesis supports Sabia's conclusion that coitus was an "observable indicator of depression" (p. 821). Furthermore, this study expands on the relationship between coitus and psychological distress by providing the scientific community with evidence that one may be able to use either early coitus or early depressive symptomatology as a marker for the subsequent occurrence of the other. However, early coitus and psychological distress do not appear to occur as a result of the other. Instead, one needs to address the process that appears to explain *both* the increased likelihood of early sexual onset and higher levels of depressive symptomatology. The biopsychosocial factors utilized in this thesis provide some predictive utility for identifying those with an increased likelihood to engage in earlier sexual intercourse.

Summary

Past research has suggested a conflicted relationship between earlier sexual intercourse and depressive symptomatology (Hallfors et al., 2004; Hallfors et al., 2005; Lehrer et al., 2006; Rector et al., 2003; Sabia, 2006; Tubman et al., 1996). This study suggests that the effect of age of first coitus on depressive symptomatology is spurious, in that, both sexual intercourse and depressive symptomatology are predicted by similar biopsychosocial variables. Therefore, there is no causal association between age of first coitus and depressive symptomatology after biopsychosocial variables are included in the equation. It is plausible that this spurious relationship may have produced contradictory evidence that has been reported in previous literature.

While one may be able to use early coitus as a marker for the subsequent elevated levels of depressive symptomatology, this elevated state does not occur as a result of earlier sexual initiation. The use of depressive symptomatology as a marker for earlier coitus, however, does not provide any predictive power. With the absence of any predictive effect of previous depression on earlier sexual intercourse, one would be unable to use higher levels of depressive symptomatology as an indicator for earlier sexual activity. Instead, the biopsychosocial factors provide some predictive utility for identifying those with an increased likelihood to engage in earlier coitus. Since both depression and early sexual onset appear to be concomitant outcomes of a similar biopsychosocial process, one needs to address the underlying process to explain these outcomes.

Strengths

The strengths of this study in relation to previous research include a long term seven-year longitudinal study, the ability to address the majority of right-hand censoring for identifying age of first coitus, the inclusion of a multiple range of factors for analysis grounded within a theoretical framework using the biopsychosocial focus, and the exploration of the bi-directional relationship between coitus and depressive symptomatology.

Past empirical evidence has focused on the relationship between early age of coitus and depression over approximately 12 months. This study addressed the relationship between earlier coitus and psychological distress over a seven-year time period, providing results that are more representative of adolescence and early adulthood. Granted, short-term effects on mental health resulting from earlier age of first coitus may exist, but these are likely transitory. However, even the short-term effects of early coitus on depression are difficult to determine based on the previous results because of the limitation of only having a one-year interval between data collection cycles. Many of the adolescents, especially those in the earlier grades, would not had a long enough time to begin to engage in sexual relations. For example, many of those in grade seven in Wave I would have been in grade eight in Wave II. While some would have engaged in their first sexual intercourse by grade eight, this would have been a minority of students. As such, these students were deleted in the previous analyses, leading to the second strength of this analysis – its ability to account for most cases of right-handed censoring.

The original Add Health survey included those in grades seven to twelve in 1994. Since those adolescents in grade seven at Wave I would likely have completed high school at the time of the third Wave if they followed the expected trajectory, the early grade students were given much greater time to have participated in sexual relations over seven years. Past empirical research has not been able to address the issue of right-hand censoring, in that, previous literature was either cross-sectional or one-year longitudinal studies. Therefore, this study goes beyond previous research to address those teens who engaged in their first sexual intercourse after two years.

This was also the first study to ground the relationship between age of first coitus and depressive symptomatology within a sound theoretical framework using a multiple range of biopsychosocial factors. Although previous research utilized a handful of biological and sociological factors, there was little rationale for the inclusion of various covariates and control variables. This thesis was able to provide an analysis that is more comprehensive than past literature utilizing the biopsychosocial framework, and how this framework would affect the relationship between earlier coitus and psychological distress.

Finally, this study explored the bi-directional relationship between depressive symptomatology and earlier age of first sexual intercourse, or, the question of "which comes first?". Past literature has provided contradictory evidence of a bi-directional relationship, generally exploring the research question in one direction. Moreover, the focus on one direction at the neglect of the potential of any bi-directional relationship implies a certain bias in perspective that was not grounded in any theoretical framework.

This bias may partly explain the equivocal findings across studies as they were unable to demonstrate whether earlier coitus predicted subsequent depressive symptomatology or whether depressive symptomatology predicted earlier age of first sexual intercourse. This study suggests that these equivocal findings were a result of a spurious relationship between sexual onset and depressive symptomatology, as both were explained by biological (age, sex, race, pubertal maturity), psychological (self-esteem, social support), and sociological determinants (socioeconomic status, religious involvement). That is, early coitus and depression appear to be multiple concomitant outcomes of the biopsychosocial process.

Limitations

There are five limitations in the current study that require some attention. First, the findings of this thesis are not generalizable beyond the current cohort of study, or beyond the United States. The Add Health is a nationally representative longitudinal study from the United States that began in 1994. Thus, this thesis provides a comprehensive analysis of the sexual activity and mental health of the adolescent U.S. population that began in 1994, sampling students from grade 7 to grade 12. However, as with any longitudinal cohort study, it is only generalizable to people of the age cohort originally sampled. As such, it cannot generalize to adolescents in school now. Without some process in place to continually replenish and follow up the younger ages of the sample, as the sample cohort ages, any cohort study becomes limited to the originally sampled cohort. In addition, since this sample comes from the United States, the results cannot be generalized to other countries or cultures. For example, Black American

adolescents and Blacks from a different country may have disparate sexual behaviors and biopsychosocial influences that may affect their mental health. Thus, biopsychosocial variables may differ from one country to another even among the same racial background. Finally, the teenage pregnancy rate in the U.S. is very high compared to all other developed countries. As a result, the conclusions of this thesis may not be generalizable to teens in countries where sexual intercourse is practiced more conservatively, or in countries that are more liberal and promote safer sexual behavior.

In addition, it would be relevant to address the same research questions among the gay and lesbian community from a nationally representative longitudinal study. This thesis examined a heterosexual population due to the independent associations for same-sex attraction and depression. This spurious relationship that exists among heterosexual teens may or may not exist among homosexual, bisexual, or asexual adolescents.

Second, in this thesis, there is an underrepresentation of psychological assessment measures due to an absence of these variables in the Add Health survey data. Additional psychological variables may account for added variance in the relationship between psychological distress and age of first genital union. However, although underrepresented, the psychological variables in this thesis provided significant results. These results suggest, especially with respect to depressive symptomatology (recall that psychological variables accounted for the largest percentage of variance in mental health; 4.60%), that psychological factors may be more predictive of mental health than previously believed. Future studies would benefit from assessing extraversion and impulsiveness among adolescents, as these variables have been found to be associated

with both depression and coitus (refer to the previous section on *Psychological Determinants of Adolescent Sexual Intercourse and Depression*). Unfortunately the Add Health does not provide a clear measure of extraversion or impulsivity, thus, this thesis was unable to address this potential relationship.

Third, there were many biological factors described in chapter one of this study that were predictive of depression and early sexual onset that I was unable to examine, as they were not assessed by the Add Health. In addition to the biological factors included in this analysis, testosterone (Halpern et al., 1993; Hyde & DeLamater, 1997), higher levels of dopamine (Giuliano & Allard, 2001; McKim, 1997; Melis & Argiolas, 1995) and the absence of the dopamine receptor DRD2 (Melis & Argiolas, 1995; Miller et al., 1999) have been previously found to be associated with an increased likelihood of participation in earlier sexual intercourse. Furthermore, a hyperactive hypothalamic-pituitary-adrenocortical axis (Arborelius et al., 1999; Duval et al., 1997; Krishnan et al., 1991; Nemeroff et al., 1984; Taylor, 2003), low serotonin levels (Duval et al., 1997) and having a depressed relative (Fendrich et al., 1990; Hallfors et al., 2004; Kendler et al., 2006; Lewinsohn, et al., 2000; Reinherz et al., 2003; Shiner & Marmorstein, 1998; Sullivan et al., 2000) have been found to be associated with an increased risk for depression. As such, biology may have a larger role in predicting both earlier sexual onset and the possible likelihood of depression than this study was able to assess. However, even with the limited number of biological factors included, this thesis still demonstrated the absence of any directional link between early sexual intercourse and depression. The inclusion of additional biological markers would likely provide stronger

support for these findings. The explanation for the relation between early first intercourse and depression may lie in some of the untested biological variables mentioned in this thesis.

This study followed a biopsychosocial theoretical framework in studying early coitus and mental health. Thus, the research questions were designed to clarify the possible bi-directional relationship between these two variables, and, as such, the additional relationships that exist between the biological, psychological, and sociological variables were not assessed. The biopsychosocial theory separates the interaction of biological, psychological, and sociological factors amongst themselves. For example, race is classified as a biological factor in this study. However, it is imprudent to believe that one's race is not affect by one's environment. Nor can it be said that one's gender is not influenced by society. Thus, this thesis did not assess socio-cultural constructions such as ethnicity or gender identity. Rather, it assessed the primary factors that constitute these constructions.

The fourth limitation of this study was that there was a substantial loss of cases due to various sources of attrition. The final weighted longitudinal sample used for analysis (n=6,510) was 60.12% of the final unweighted longitudinal sample collected by the Add Health (n=10,828) (see Table 1). However, the final sample utilized in this study employed the sample weighting technique to adjust for attrition. As a result, the data used in analyses maintained its representation of the national population in this age group.

Finally, this thesis used eight items of the 20-item CES-D scale. While Waves I

and II contained 18 of the 20 items of the CES-D, in an effort to add content to the survey in Wave III, the original architects of the study decided to reduce the number of items to measure psychological distress. While this potentially reduces the utility of this constructed measure's accurate portrayal of psychological distress, a factor analysis of these 8 items revealed a similar factor structure to previous analyses of the 20-item scale (Radloff, 1977; Roberts et al., 1990), leading to confidence in the results of this thesis. Thus, since the Add Health utilized 8 items across all three Waves of data collection, this thesis was restricted to the use of these 8 items. Furthermore, previous literature has used only 1 item of the CES-D scale, which was dichotomized, to assess depression. Thus, this thesis improves on past studies, in that, it utilizes a more robust continuous scale of depressive symptomatology. Moreover, the final sample was characterized by lower levels of depressive symptomatology suggesting that any findings are more likely to attenuate any associations, leading to a greater confidence in the results.

Implications

The results from this thesis are beneficial for research, clinical work, as well as population health policy and programs. This study moves the field of research ahead as a result of the rigorous testing of the research questions within a biopsychosocial framework. Previous research has neglected both a theoretical framework and a longitudinal exploration of the bi-directional relationship between coitus and mental health. Thus, this study improves on past research and lays a foundation from which this relationship can be further assessed. For example, future research may explore a different theoretical framework, such as feminist theory, to assess the spurious

relationship between sexual intercourse and depressive symptomatology. For example, sexual intercourse has very different implications for males and females, in that, males are praised for their participation in sexual intercourse while females are discredited for their involvement in coitus. Thus, it is plausible that males have higher self-esteem and females have lower self-esteem from the labels that society places on them.

This study suggests that self-esteem may be a robust predictor of both earlier age of first sexual intercourse and depressive symptomatology. Self-esteem had a very strong correlation between depressive symptomatology at Wave I (r=-0.501, p<.001), II (r=-0.368, p<.001), and III (r=-0.209, p<.001), and age of first coitus (r=0.054, p<.001) (see Table 11.1). Thus, self-esteem may be a potential underlying factor associated with earlier sexual intercourse and depressive symptomatology. Perhaps, clinical work that addresses sexual behaviors and mental health is only treating the symptoms and missing the underlying factors, such as self-esteem, that are predictive of these behaviors. Thus, interventions directed towards youth, based on the factors that influence both earlier coitus and depressive symptomatology in sexual health campaigns might be beneficial for adolescents as well.

From a policy perspective, this study has important implications. This study provides evidence that is contrary to the assertion that was made by the U.S. congress imposing legislation (Welfare Reform Legislation) that includes financial provisions for programs that promote sexual "abstinence only". The findings of this thesis, including Meier's (2007) study, suggest that sexual intercourse is not significantly related to future mental distress. Thus, it would most likely be beneficial to provide adolescents with

curricula that discuss smart sexual behaviors including abstinence, instead of a myopic focused learning program. Furthermore, since the U.S has one of the highest teenage pregnancy rates in the developed world, the results of this thesis can inform us as to some of the determinants associated with earlier sexual intercourse. Thus, one could use early sexual onset as a marker for subsequent mental health difficulties. However, based on results of this thesis, by changing sexual behavior, one is not going to prevent future mental health problems. Therefore, it is important to look past the concomitant outcome and understand the underlying process and risk factors involved that predict both earlier sexual intercourse and depressive symptomatology.

Finally, although the findings of this thesis were statistically significant, very little variance was explained in the final model. Thus, there is a large portion of the variance in depressive symptomatology and early intercourse that is unaccounted in this thesis. Perhaps, the many changes involved between adolescence and adulthood account for additional variance in this relationship. For example, the transition from high school to the work world, the financial stressors associated with adulthood (rental, insurance, mortgage, and bill payments), the added responsibility of parenting, or the stress associated with cohabitation, marriage, or divorce may account for this disparity.

Future Research Directions

Due to the longitudinal nature of this thesis, it accounts for the multiple changes that are characteristic of the period from adolescence to adulthood. Examining the relationship between age of first coitus and depression across different cultures would provide support to the generalizability and consistency of these results, in that, one could

conclude that the results are characteristic of most adolescents instead of U.S. adolescents. In addition, the inclusion of empirical research on biological factors that have been found to influence age of first coitus (higher levels of testosterone and dopamine, the presence of the dopamine receptor DRD2) and psychological distress (a hyperactive hypothalamic-pituitary-adrenocortical axis, low serotonin levels, a depressed relative) would provide a comprehensive understanding to the present body of knowledge on this subject by addressing the amount of variance that each explains in this relationship.

Concluding Remarks

This thesis attempted to address the equivocal findings and identified limitations in previous research that has looked at the relationship between early coitus and depression among adolescents. Moreover, it incorporated a theoretical framework, the biopsychosocial perspective, in which to examine the relationship between early onset penile/vaginal sexual intercourse of adolescents and depressive symptomatology as they enter into adulthood accounting for the role of biological, psychological, and sociological factors. The equivocal findings in past literature in the temporal ordering of first sexual intercourse and depression signified a problem in deciphering the temporal ordering between them. While the majority of previous research indicated early onset of sex preceded depression, others identified the reverse pathway as plausible. This study suggests that these equivocal findings were a result of a spurious relationship between sexual onset and depression, as both were explained by biological (age, sex, race, pubertal maturity), psychological (self-esteem, social support), and sociological

(socioeconomic status, religious involvement) determinants. That is, early coitus and depression appears to be multiple concomitant outcomes of the biopsychosocial process. As such, it is now necessary to move beyond previous research and begin to examine more thoroughly these predictive processes.

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APPENDIX A: 8-Item Center for Epidemiological Studies-Depression (CES-D) Scale

*[Reverse-coded items indicated by *]*

How often was each of the following true during the last week?

1. You were bothered by things that usually don't bother you.
2. You felt that you could not shake off the blues, even with help from your family and friends.
3. You felt that you were just as good as other people.*
4. You had trouble keeping your mind on what you were doing.
5. You felt depressed.
6. You enjoyed life.*
7. You felt sad.
8. You felt that people disliked you.

APPENDIX B: Self-Esteem Scale

1. You have a lot of good qualities.
2. You have a lot to be proud of.
3. You like yourself just the way you are.
4. You feel like you are doing everything just about right.
5. You feel socially accepted.
6. You feel loved and wanted.